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A novel supermicrosurgery training model: The chicken thigh

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Summary *Background:* Supermicrosurgery is an increasingly important technique in reconstructive surgery. It requires a more technically refined skill set compared with standard microsurgery. All currently available biologic training models involve the use of live rats. A nonliving model would be more accessible and cost-effective for practice. We have developed such a model using chicken thighs purchased from a local grocery store.
Methods: The ischiatic neurovascular bundle was identified in 20 chicken thighs and dissected distally to the end of the specimen. The vessel diameters were measured at several points along the artery, vein, and their respective branches. Vessels with diameters in the 0.3–0.8-mm range were then divided and supermicrosurgical anastomoses were attempted.
Results: The branching pattern of the ischiatic artery and vein were anatomically consistent with intermediate and terminal secondary and tertiary branches consistently in the range of 0.3–0.8 mm. In all specimens, at least one 0.3-mm vessel could be identified, though additional intramuscular dissection was sometimes required. It was demonstrated that supermicrosurgical anastomoses could be successfully performed using these branches.
Conclusions: This study introduces a novel, convenient, and economical model for supermicrosurgery utilizing easily obtained chicken thighs. The chicken thighs have an anatomically consistent vascular branching pattern, and vessels of appropriate sizes for training can be

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easily identified and isolated. Surgeons looking to develop or refine supermicrosurgical skills may find this nonliving, biologic model very useful.

Introduction

Supermicrosurgery, the technique of anastomosing vessels <0.8 mm,[1] has been increasingly utilized in reconstructive surgery in procedures such as fingertip replantation,[2] perforator-to-perforator free tissue transfer,[3,4] and lymphaticovenular anastomosis (LVA). For LVA in particular, venules and lymphatics of 0.5 mm in diameter or smaller are routinely selected for anastomosis.[5] Even more than in standard microsurgery, supermicrosurgery demands rigorous eye—microscope—hand coordination, dexterous handling of delicate tissues, and fluid, fine motor skills. These technical skills need to be developed and practiced for these technically demanding procedures to be successfully performed.

Currently available biologic supermicrosurgical training models all involve the use of live rats.[6–8] While these provide vessels of adequate caliber for supermicrosurgical training, animal models are expensive and require dedicated research programs, animal use certification and care protocols, and specialized facilities. These factors can make training with the animals impractical, if not impossible, for many surgeons seeking to develop these specialized skills.

The purpose of this study was to develop a cost-effective and biologically realistic training model for supermicrosurgery that is more easily accessible than the previous models that have been described.

Materials and methods

Specimens

Twenty-two chicken thighs were obtained from a grocery store without consideration given to the age of chicken and the size and weight of the individual thighs. Specimens were examined to assure that excessive injury to the vasculature had not been incurred during processing of the poultry. Two specimens were found to have exposed ischiatic vessels and muscle tear and were eliminated; hence, 20 specimens were included in the study. Dissection and supermicrosurgical anastomoses were performed by two microsurgeons and one microsurgery fellow.

Dissection technique

With the femur oriented vertically toward the surgeon's left-hand side and the skin side of the chicken thigh facing down (toward the bench), the ischiatic neurovascular bundle was exposed by dissecting along the areolar plane between the iliotibialis and iliofibularis muscles (Figure 1). The iliotibialis and iliofibularis were reflected to the left and right, respectively, as the dissection proceeded. Optimal exposure of the vasculature was achieved by partial excision of both muscles. The primary branches of the ischiatic artery and vein were skeletonized and traced with antegrade dissection to sequentially identify the secondary and tertiary branches (Figure 2). The dissection was terminated when one of the following two end points was reached: 1) when any of the branches reached the size of 0.3 mm or 2) when the dissection reached the rightmost end of the specimen.

Equipment and instruments

Zeiss Opmi Primo ceiling-mount microscope (Carl Zeiss Meditec, Jena, Germany) with maximum magnification of 21.3× was used. Magnification of 8.5× or less was used for the initial dissection of the ischiatic neurovascular bundle and its primary branches. When reaching vessels <0.8 mm, 13.6× and 21.3× magnifications were required to adequately skeletonize and prepare the vessels for supermicrosurgical anastomosis. A magnification of 21.3× was used exclusively for supermicrosurgical suturing. Synovis S & T standard and superfine microsurgical instruments (Synovis, Neuhausen, Switzerland) were used. Synovis S & T type V, 12/0 nylon suture (Synovis, Neuhausen, Switzerland) with a 50-μm-diameter needle was used for supermicrosurgical suturing. Measurements of vascular branches were taken with Shinwa stainless steel gauge, model 58698, with a precision to the nearest 0.05 mm (Shinwa Measurement, Niigata, Japan) (Figure 3).

Results

The ischiatic artery and vein consistently sent off primary branches at the mid-femoral point. The primary arterial

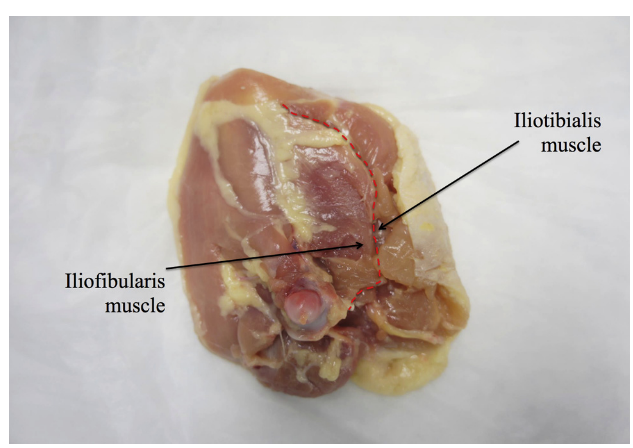

Figure 1 The ischiatic neuromuscular bundle is exposed by dissecting the areolar plane between iliotibialis and iliofibularis muscles. The exposure of the vasculatures is enhanced by partial excision of both muscles.