Microvascular Training Curriculum for Orthopaedic Surgery Residents

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Introduction

Microsurgery is a specialized surgical skill set utilized by a subset of orthopaedic surgeons who perform free tissue transfers, nerve grafting, and replantation of amputated digits or extremities. Many orthopaedic residency training programs do not offer consistent and structured exposure to this skill due to variable clinical exposure and limited availability of adjunct training facilities. Despite the specialized nature of microsurgery, it is our belief that it is a vital skill to develop during an orthopaedic residency because it has implications for improving macrosurgical technique and may influence a trainee’s future career choice.

Traditionally, surgical skills have been developed and refined in the operating room under the direct observation of a supervising surgeon. However, the evolution of graduate medical education has lead to a reduction of the total working hours available for training, a focus on the prevention of adverse outcomes associated with teaching surgical trainees, and an increased premium on operating room efficiency. This presents a unique hurdle in the acquisition of microsurgical skill steep learning curve associated and the potentially catastrophic complications associated with a failed anastomosis. Combined, it makes it difficult for trainees to obtain hands on exposure to this skill.

At our institution, we are currently implementing a new microsurgery training curriculum which will be integrated into each resident’s rotation on the hand and upper extremity surgery service. Our aim is to document and quantify the effect that the new curriculum will have on each resident’s training, both subjectively and objectively.

Hypothesis

A hands on microsurgery training curriculum will improve resident comfort with and performance of microvascular anastomosis.

Methods

Each resident spends 10 weeks on the hand and upper extremity service during their third year of training. During this rotation each resident participated in a weekly microsurgery training session. Each training session is progressive in nature beginning with the basics of microsurgery, to the development of surgical technique on non-living models, and eventually working on live animal models. Live rat models were used for the purpose of practicing arterial and venous anastomosis. The rate femoral artery and vein are very similar to the size and feel of human vessels and is the standard model used for simulating microvascular anastomosis.

The basics of microsurgery were taught to each resident through a step-wise progression designed to last for a total of 8 sessions on a once weekly basis under the direct guidance of a fellowship trained hand surgeon with extensive microvascular surgery experience. The topic of each of the sessions is listed below.

1. Animal handling
2. Familiarization with microscope and microsurgical tools
3. Sewing anastomoses on non-living model
4. End-end arterial anastomosis on rat model
5. End-venous anastomosis on rat model
6. End-side arterial anastomosis on rat model
7. End-side venous anastomosis on rat model
8. Practical examination (end-end arterial anastomosis)

A pre-curriculum and post-curriculum questionare was given to each of the residents. A subjective evaluation of resident skill was made during the initial end-end arterial anastomosis and at the final practical examination using a standardized evaluation form (shown below). The time to completion of the anastomosis were determined for each anastomosis.

Evaluation

Global Rating Scale for Microvascular Anastomosis

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<tbody>
<tr>
<td>Respect for tissue</td>
<td>Frequently used unnecessary force on tissue, caused damage, inappropriate use of instruments</td>
<td>Careful handing of tissue, but occasionally caused inadvertent damage</td>
<td>Consistently handled tissue appropriately with minimal damage</td>
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<tr>
<td>Time and Motion</td>
<td>Many unnecessary moves</td>
<td>Efficient time/motion, but some unnecessary moves</td>
<td>Economy of movement and maximum efficiency</td>
<td></td>
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<tr>
<td>Microinstruments handling</td>
<td>Repeatedly makes tentative or awkward moves with instruments</td>
<td>Competent use of instruments although occasionally appeared stiff or awkward</td>
<td>Fluid moves with instruments with no awkwardness</td>
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<tr>
<td>Performance of anastomosis</td>
<td>Poorly placed sutures and poor use of irrigation and vasodilator</td>
<td>Fair placement of suture and use of irrigation and vasodilator</td>
<td>Well placed sutures and appropriate use of irrigation and vasodilator</td>
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<tr>
<td>Patency</td>
<td>Poor, thrombosed</td>
<td>Moderate, reduced flow</td>
<td>Excellent, unimpeded flow</td>
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Results

Residents in our program do not receive enough microvascular surgery training. A dedicated microvascular surgery training curriculum has been effective in improving the knowledge, comfort level, and surgical performance of the orthopaedic residents in our training program. We will continue to utilize this microvascular training as part of our core curriculum and analyze its benefits to enhance the experience and skill of our orthopaedic surgical trainees.

Funding

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Conclusion

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