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Original Article

Using of the Chicken Wing's Bone in the Microneusurgical Training Model for Microdrilling

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Abstract

Background and Objective: Repetitive practicing of microneurosurgical techniques in experimental laboratory using real surgical instruments on training models is extremely important before starting the real surgical interventions. The modeling of the surgical steps with creating of suitable laboratory models is also another important issue in the successfully gaining of microneurosurgical practice. **Materials and Methods:** In this experimental study, it was created a laboratory training model for microneurosurgical drilling of cranial bones including the close location with the neural and vascular structures. All steps of this study were performed under the operating microscope. Twenty-five fresh chicken wings obtained from supermarket were used for this study. The difficulty and suitability of the model was evaluated in terms of the usability in the training of microneruosurgical microdrilling. Difficulty of the procedure was divided as three degree (very easy, easy, and difficult). The objective criterion for the evaluation of the difficulty of the procedure was the protection of the neurovascular and muscular structures during the procedure. **Results:** The suitability of the procedure was also evaluated within three groups as bad, good, and perfect. In four (16%) chicken wing's bone, the difficulty of the microdirilling was evaluated as difficult. Fifteen (60%) of the chicken wing's bones were microsurgically drilled with easy procedure. The remaining six (24%) of the wing's bone microdrilling was evaluated as very easy procedure. The suitability of the model was evaluated as bad in three (12%) of the chicken wing's bone. The suitability was found as good in 16 (64%) of the bones. In the remaining three (24%) of the chicken wing's bone microdrilling, the suitability of the model was evaluated as perfect. **Conclusion:** Microsurgical drilling of the chicken wing's bone without any vascular and muscular injury is accepted as the indication of the successfully surgical microdrilling process. Consolidation of the surgical practice in a laboratory setting, grasping and using of microsurgical instruments, can be repeated in several times in this model. We believe that this model will contribute to the practical training of microneurosurgery.

Keywords: *Chicken wing's bone, microdrilling, microneurosurgery, training of microsurgery*

Introduction

Training of microneurosurgery including microdrilling of the bone using high-speed drill is extremely important in the microsurgery practice.[1-3] Theoretical and practical training of microneurosurgery includes many difficult, time and ability requiring steps in neurosurgical period of life.[1-3] Specific microneurosurgical techniques such as properly using of the operative microscope, holding and grasping of the microneurosurgical instruments, proper microsurgical technique of the opening of the arachnoid membranes, safe and delicate neurovascular dissection, and carefully and properly microdrilling of the cranial base bones should be learnt before taking place in front of the patient's head in the operating room.[1,4-8] Spending of time in experimental microsurgical laboratory to practice some kind of microsurgical models, such as dissection and suturing of the rat external carotid artery, dissection and evaluation of the abdominal vena cava of rats, suturing of the plastic glove materials by using micro forceps under the operating microscope, and drilling and dissection of some cadaveric bone materials, are essential improving and gaining of advanced microneurosurgical practical techniques.[1,3-8]

Removing of the bony structures located in the extradural and intradural cranial space are necessary during the intervention of some kind of operations such as intranasal transsphenoidal hypophysis surgery, removing of anterior clinoidal process, tympanic and mastoid bone drilling, and C1 bone removing around the vertebral artery.[2] It is critically important that intradurally and/or extradurally removing

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of the thin and delicate bony structures overlying of some important and critical neural and vascular structures needs advanced microsurgical microdrilling techniques before the performing of operations.

In this experimental study, it was developed a practical model by using chicken wing's bone in the microsurgical training model for drilling of the intradural and extradural critically cranial bone. Chicken wing's artery previously proposed as a micronanastomosis training artery.[8] In this model, it was proposed that the comprehensive model includes the sharp cutting of membranous structures, dissection and identification of vascular structures, and separation and retraction of muscular structures until reaching down to the bone. The identification, separation and dissection process using sharp and blunt microsurgical instruments under the surgical microscope need specific microsurgical techniques. Repetitively doing these steps of the proposed microsurgery training model may be resulted with learning of specific microneusurgical techniques. The material using in this experiment is very easy and cheap material to find in common daily of life.

In this experimental modeling study, it was evaluated that the microdrilling of chicken wing's bone using high-speed microdrill in the contribution of the using and handling ability of the microdrilling process. In the other hand, it was also evaluated that the feasibility of the using of this model in the microdrilling of intradural and extradural cranial bones in clinical microsurgical practice. Experimental findings, difficulties, practical methods, and suggestions were discussed under the light of the literature.

Materials and Methods

This study was performed in Microneurosurgery Laboratory of Neurosurgery Department, Faculty of Medicine after institutional approval for study and publishing. Thirty-five chicken wings were used in this experimental feasibility study. Aluminum wire mesh tray was used for stabilization of the surgical materials under the operating surgical microscope (Zeiss Surgical Microscope, Germany). Rubber elastic bands were used for fixing of the surgical materials in the aluminum mesh tray [Figure 1]. The axillary surface of the chicken wings was used for this experiment. The skin over the surface was cut the using microscissor [Figure 1]. The opening of the skin was shown in Figure 1. The sulcus located between the two main mass groups was used for dissection, separation, retraction, and reaching down to the tubular bone located deep inside the sulcus [Figure 2]. Dissection and separation of the muscle bundles was shown in Figure 2. During performing this experimental process, the wings artery may be identified just anterior surface of the main muscular mass [Figure 3]. The microdissection of the chicken wing's bone and separation of the artery was shown in Figure 3. This artery is very near to the bone and it is suitable to use for protection of the microdrill tip to enhanced microsurgical technique. Before starting the microdrilling process, the periosteum of the bone should be dissected, separated, and opened [Figure 4]. The opening of the periosteum was shown in Figure 4. Following the separation and retraction of the vascular and muscular structures around the bone, the experimental process should be carried out with the bone microdrilling [Figure 5]. The microdrilling of the bone is shown in Figure 5. Using high-speed microsurgical drill (Midas Rex® Legend® Electric System, USA), the surface of the chicken wing's bone was microdrilled with proper attachment (Small Bore Variable Exposure Attachment) and tools (4 mm ball and 4 mm ball diamond) of the Midas Rex® Legend® Electric System for opening of the burr holes [Figure 6]. The final appearance of the bone drilling was shown in Figure 6. Multiple burr holes may be opened during this process.

Difficulty and suitability of the procedure was analyzed in the evaluation of the model. Difficulty of the procedure was divided as three degrees (very easy, easy, and difficult) in according to the description of the performer. The main objective criterion for the difficulty of the procedure was described as the protection of the soft structures including vascular and muscular structures during the procedure. The suitability of the procedure was also evaluated within three groups as bad, good, and perfect.

Results

In four (16%) wing's bone, the difficulty of the microdirilling was evaluated as difficult. Fifteen (60%) of the wing's bone was microdrilled with easy procedure. The remaining six (24%) of them, microdrilling was evaluated as very easy. The suitability of the model was evaluated as bad in three (12%) of the wing's bone. The suitability was found as good in 16 (64%) of them. In the remaining three (24%) of the wing's bone microdrilling, the suitability of the model was evaluated as perfect. Microsurgical drilling of the wing's bone without any vascular and muscular injury located just around of the tubular bone is an indication of the successfully surgical microdrilling process. Microforceps, microhook, and microdissector may also be used in the identification, separation and dissection of the vascular and muscular structures to imitate microsurgical steps (separation and dissection of the neurovascular structures). Microdrill tips with different features and sizes may be able to use in this model. The rotation speed of the microdrill and the effect of rotation speed on the microdrilling process may be evaluated in this experimental model.

Discussion

Regional microneurosurgical neuroanatomical and microsurgical instruments should be known and recognized for a safe microneurosurgical intervention.[1] It is crucial the using of these instruments with appropriate microsurgical techniques.[1] It is imperative that surgical techniques should be repeated several times on

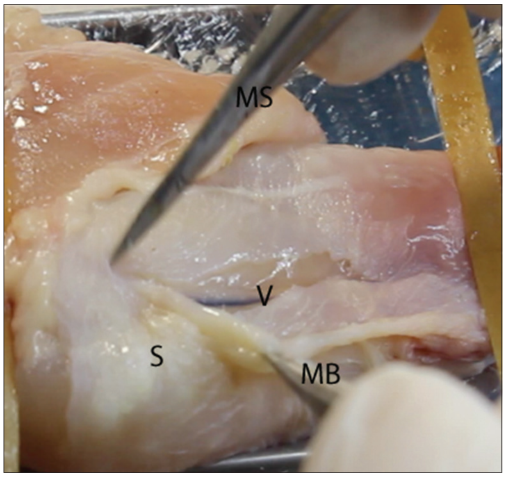

Figure 1: The opening of the skin by using microscissor and microbatonet (MS – Microscissor; MB – Microbayonet; V – Vessel; S – Skin)

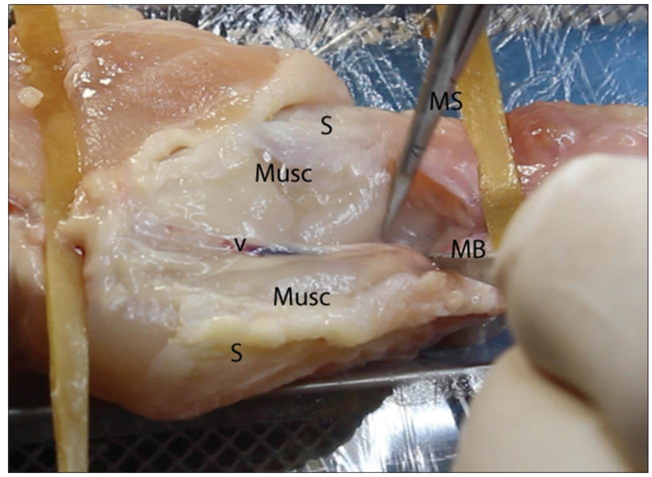

Figure 2: The microdissection of the muscle bundles through down to the bone segment (MS – Microscissor; MB – Microbayonet; V – Vessel; S – Skin; Musc – Muscle bundle)

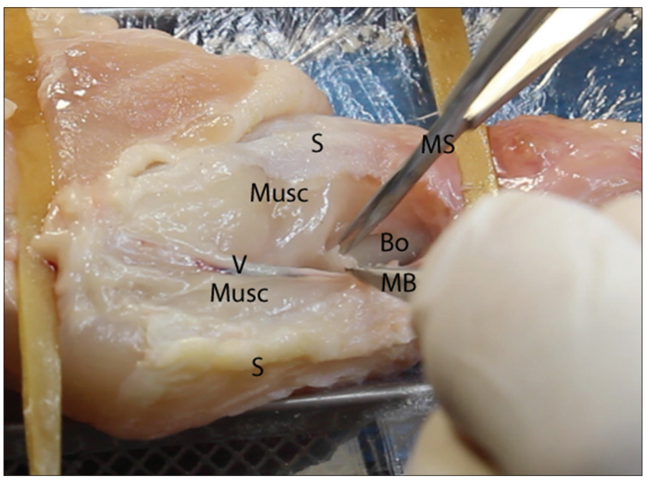

Figure 3: The opening of the skin by using microscissor and microbatonet (MS – Microscissor; MB – Microbayonet; V – Vessel; S – Skin; Bo – Bone; Musc – Muscle bundle)

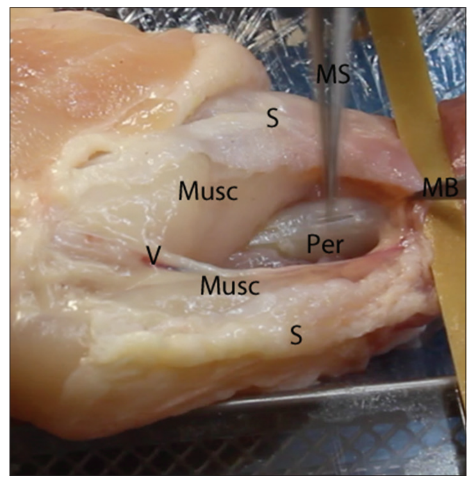

Figure 4: The opening of the periost by using microscissor and microbatonet (MS – Microscissor; MB – Microbayonet; V – Vessel; S – Skin; Per – Periosteum; Musc – Muscle bundle)

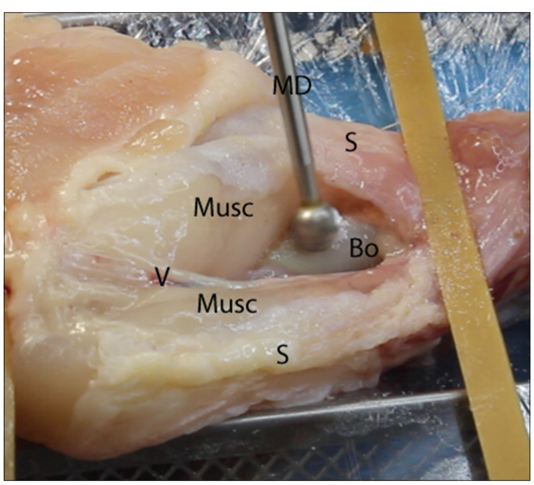

Figure 5: The microdrilling of the bone after opening of the periosteum by using microdrill (V – Vessel; S – Skin; Bo – Bone; MD – Microdrill; Musc – Muscle bundle)

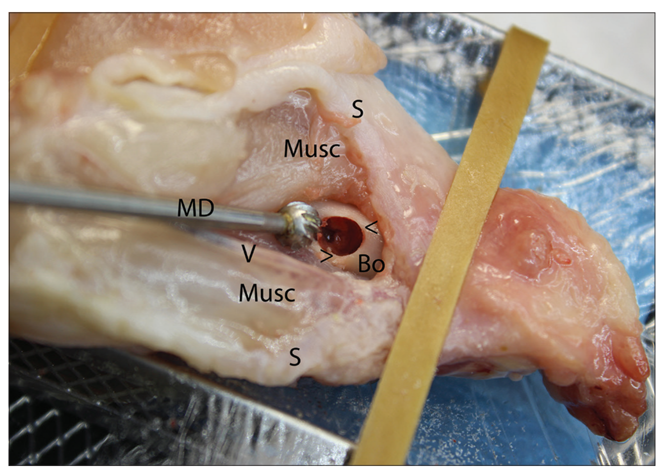

Figure 6: The final appearance of the microdrilling process of the bone after opening of the periosteum (V – Vessel; S – Skin; Bo – Bone; MD – Microdrill; Musc – Muscle bundle, arrows shows the drilling area)

appropriate models to successfully maintain and terminate microsurgical interventions.[1] Before a real operation performing on human beings, it is extremely necessary that understanding of abilities of some sophisticated devices to be used in the microneurosurgical intervention, and in addition, it is required for the person to develop his or her own abilities and to create integrated surgical techniques.[1,3-8] Microneurosurgical operation performed on human subjects can be properly staged. Each step carries unique features. In training of microneurosurgery, stepped or staged microsurgical training is the most commonly used learning methods. Vascular end-to-end, end-to-side, side-to-side anastomosis, aneurysm clipping, and sylvian fissure dissection may be given as example for staged microsurgical training.[3-8]

In this model, using of chicken wing's bone microdrilling is proposed as a training model for delicate and thin cranial bone microdrilling. Microsurgical drilling of the bone using minimally invasive technique is necessary during the surgical treatment of pathology located within the intracranial location. Microsurgical training of microdrilling is extremely important in the reducing of surgical complication related with the bone drilling. Repetitively doing of the surgical steps on the models is necessary for training of bone drilling. Appropriately holding of the electrically powered high-speed drill without any injury around the neurovascular and delicate tissues is the critical topic of training models.

The proposed model should have some partial similarities of the represented model to speak of an appropriate and successful model. On the other hand, another important issue is the easily obtainable and cheap properties. Other important issues are the short and easy preparation period of the model before using under the operating microscope without including any complicated steps. Repetitive operations on the model in various ways can be accountable as a positive advantage. When taking into consideration the ethical issues, live models, in addition to the above-mentioned disadvantages, compromise some problematic limitations in experimental practice. It can be seen some advantages when we evaluate the fresh cadaveric chicken wings under the light of the parameters detailed above.

The fresh cadaveric chicken wings are an inexpensive material that can be obtained easily because the chicken is a food source consumed through nutrition. Because the fresh cadaveric chicken wing is not a living model, there is no need for local ethical committee permission. Hence, there are no ethical restrictions in this model in comparison with live models. When we think of all these features together, the fresh cadaveric chicken wings should be regarded as a suitable model in the experimental microneurosurgical microdrilling of the critical cranial bones training model.

In this experimental study, fresh cadaveric chicken wings were used for this model. The first step of the microsurgical step is to open the skin of the operative site. Properly dissection and separation of the muscular mass is the following step of the modeling surgery. In this step of the operation, one can be able to use sharp and blunt microdissection of the tissues reaching down the neurovascular and bone structures within the mass. In this step, microscissor, microdissector, and microbayonet can be used during the surgery. Dissection, separation, and retraction should be used in several times. Identification and protecting of the neurovascular bundle is also important step in this study.

It is also important to recognize the specific surgical instruments used in this proposed model and gain some practice by trying them out in various ways. High-speed microdrill can be accepted as the top of these instruments. Allowing microdrills to be used in this experimental model with different tips and types makes the person more familiar with this device. The process of reducing and increasing the turning speed of the microdrill and observation of the events to occur during this process can be accounted as the other purpose of this practice.

Conclusion

Removing of the thin and delicate bone structure of the intradural and extradural cranial space by using microdrilling is one of the most important steps of the surgical intervention in the microneurosurgical practice. Before starting the surgical intervention performing on live subjects, this process should be practiced several times on practical training models such as in this proposed model in several times until practically learning. In this experimental study, chicken wing's bone is proposed as a practical model. Consolidation of the surgical practice in a laboratory setting, grasping and using of microsurgical instruments, can be repeated in several times in this model. We believe that this model will contribute to the practical training of microneurosurgery.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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