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CIS II

Seminar Presentation

Article Review

**Review of “Fundamentals of Electrosurgery” and “The Creation of Ultrasound Elastography Phantoms”**

In “Fundamentals of Electrosurgery” by BL Hainer, he discusses the properties and details of how electrosurgery uses electricity to remove tissue, coagulate bleeding, and destroy tumors. Electrosurgery has been shown to be able to accomplish cutting, coagulation, desiccation, and fulguration of tissue. He further has explained that electrosurgical equipment for the office is relatively inexpensive and portable. The main advantage of electrosurgical modality is rapid completion of the procedure and operation with minimal surgical time, due to the fact that hemostasis occurs immediately as the incision is made. After some basic instruction and initial practice on animal tissue, even family physicians can readily apply electrosurgery in an office-based practice safely, efficiently, and with satisfying results.

Hainer goes on to describe four main ways that electrosurgery can be performed in terms of varying technique and resulting tissue manipulation. Specifically, they are electrosection, electrocoagulation, electodesiccation, and electrofulguration. Electrosection the process in which an undamped, high frequency alternating current is applied to the tip of a surgical instrument and basically vaporizes cells in its path. This creates a cutting effect in the area through which the instrument is passed. This is very similar to the way in which a normal scalpel would cut tissue, but has the added advantage of minimizing blood loss. Electrocoagulation describes the process where the cells is not vaporized like in electrosection, but rather where heat is applied to a large enough area so that the cells are dehydrated and the protein contents denature. This results in the coagulating effect of blood and hemostasis, also advantageous due to the minimizing of blood lost. The other two methods of electrodesiccation and electrofulguration are secondary in relation to my project. Electrodesiccation involves the dehydrating and drying of cells by applying heat, but leaving the basic structure intact. Electrofulguration is the usage of a spark gap to char and insulate the tissue from deeper damage and destruction. Hainer focuses on the incorporation of electrosection using an undamped oscillating current and electrocoagulation using a damped oscillating current. He then claims that using a sort of blended current between the both of them allows for incisions to be made with the added effect of minimal blood loss.

Hainer then continues to describe the advantages of electrosurgery in general. Overall, the major advantage to electrosurgery is the reduced operation time due to rapid hemostasis and minimal blood loss. This is often preferred in surgical operations because the time in which blood loss is still occurring increases the risk of increased damage to the wound. As a result, being able to immediately cauterize wounds as you are making the incision is an effective and efficient way of performing surgery. Additionally, Hainer claims that electrosurgical units are easy and convenient to use and straightforward to learn and teach. Furthermore, he claims that the disadvantages include the fact that working with such high voltages and currents runs the risk of increased scarring. Also, extra caution is necessary when working near critical nerves or veins as to avoid permanent damage.

For the Schneider, et al. paper, they go into the specific details regarding the generation of two different types of phantoms used for ultrasound elastography. One is an artificial gel phantom consisting of plastisol and another is a chicken breast phantom encased in porcine gel. They go into details regarding the recipe and process of constructing these phantoms. The most relevant application to my project would be the creation of the gel phantom and the fact that its opacity and thickness of tissue can be modified, as well as the ability to embed blood vessels within the gel phantom. The processes described entail that the creation of these phantoms is fairly cheap and easy. While the intended use for this paper was for ultrasound elastography, I believe that a few simple modifications will allow these phantoms to be applicable to my project. Both phantoms proved to be very durable and simple to make, which is precisely the criteria that fits my project.

Overall, from the Hainer paper, I hope to implement and apply and test the properties that are commonly used in electrosurgery within my dissection model. Specifically, this would require that my tissue behave realistically when it comes into contact with the surgical tools. This would also apply to my embedded blood vessels, specifically to shrink when heat is applied and for the possibility of fluid within the vessels to coagulate. Finally, the gel phantoms will also coincide with my goal of creating a cheap and efficient way to make the dissection model.