Analysis of Magnetic Resonance Imaging of Peripheral Nerve Regeneration

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Introduction:

Due to accident related neural damage, many people's lives are impaired or limited in what they can do. Current medical practices are limited at helping distal and proximal nerve stubs regenerate. Many recent research studies have focused on trying to improve this problem by understanding how cut or crushed nerves heal. Our study hopes to help these efforts by improving non-invasive analysis techniques of nerve growth. Magnetic Resonance Imaging (MRI) is one possible solution to creating a reliable analysis technique that in the future could be used on humans. However, current methods of taking MRI scans involve toxic resolving fluid injections into the sight to be scanned in order to magnify the ability to distinguish nerve tissue from other tissue types in organisms. We have shown within our study that it is possible to correlate nerve regeneration in MRI images with other, mechanical tests without the use of resolving fluids.

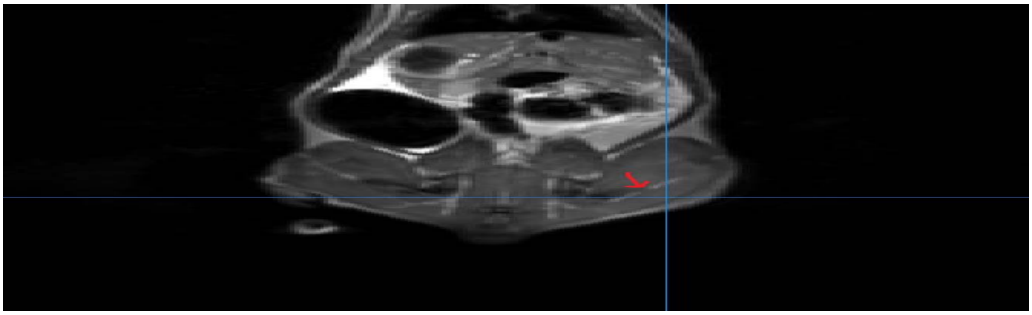
Materials and Methods:

Our study begins with rats of two groups: a nerve crush group and a nerve cut group. The first group has had their sciatic nerve crushed for 30 seconds just below the sciatic notch of the hip bone. The second group has had their nerve severed completely at the same location. The rats were then tested with various mechanical tests to test reaction times to stimuli to the foot as well as utility of the foot. This data, taken as various time points, was then correlated to data obtained from MRI scans measuring distance between nerve ends as well as visual functionality of the nerve. As well, at certain time points throughout the study, some rats were euthanized and the nerves were removed for histology analysis which was done to look at how the nerves are healing to compare with the MRI scans.

Results and Discussion:

We were able to develop a method that could successfully and consistently image the severed nerves of the rats that we had in our study. The distances are measurable and average around 2mm for each severed rat as shown in the picture with nerve regeneration distance still being measured. We are currently compiling the data that correlates nerve regeneration that is seen in the MRI with nerve regeneration as detected by a muscle reflex test and a toe spread test (to measure functionality of the nerve).

Figure 1: Severed Sciatic Nerve of Rat with a measured distance of about 2mm for each rat.



Conclusion:

We conclude, therefore, that it is possible to take MRI to image nerve regeneration without the use of resolving fluids. We anticipate that we will be able to correlate the regeneration data obtained in the MRI machine with our two other functional tests of the nerve so as to develop a method to be able to do rate functionality of a nerve based on an MRI image. A further study that we plan to conduct would be to wrap the nerves in a tube so as to promote regeneration of the nerve to further test our method.