Study: Mechanomyography to be accurate in detecting nerves during minimally invasive spine surgery

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An electronic device is an accurate technique for locating and avoiding nerves during spinal procedures, suggests a study by Henry Ford Hospital researchers.

The issue becomes important for patients as the demand for minimally invasive surgical techniques continues to grow, so does the need for effective methods for monitoring the location of nerves during surgery to avoid damage to them.

Mechanomyography (MMG) systems function by measuring the mechanical response of muscle following nerve stimulation, compared to traditional techniques that monitor the electrical response of muscle using electromyography (EMG). EMG systems are widely used as intraoperative tools to help surgeons avoid nerve injury. MMG has been widely used in laboratory settings to study things such as muscle fatigue, however up until now it has not been applied as an intraoperative tool for locating nerves.

"We felt there was a safer and faster way to intra-operatively monitor the location of nerves and we wanted to test this theory by directly comparing MMG to EMG," says Stephen Bartol, MD, orthopedic spine surgeon at Henry Ford Hospital. "We found MMG to be extremely effective for detecting the presence of nerves during minimally invasive surgical procedures when the nerves could not be directly visualized."

Dr. Bartol presented results from the study this week at the Tenth Annual Scientific Conference of the Canadian Spine Society in Alberta.

According to the National Institutes of Health, in a three-month period, about one-fourth of U.S. adults experience at least one day of back pain. It is one of the most common medical issues affecting Americans.

During minimally invasive spine surgery, a common treatment for chronic back pain, a small electrical signal is sometimes used to stimulate nerves and detect responses so that nerves are not damaged during surgery.

"Because conventional EMG systems monitor for subtle changes in muscle electrical activity, there is the potential for electrical interference. By using an MMG system, we are not worried about electrical interference since the response to electrical stimulation is measured through mechanical sensors instead," says Dr. Bartol.

In an animal model, Dr. Bartol and his colleagues measured the EMG and MMG responses to electrical current.

"We found that the MMG system had a faster response, indicating a higher sensitivity for detection of nerves at a lower threshold," says Dr. Bartol.

In another study, also presented at the conference, Dr. Bartol took a look at how the muscle response to electrical stimulus varies with the distance of the nerve from the source of the stimulus.

"We need to know exactly how far away we are from the nerve. Working with different levels of current, we were able to establish a relationship between the current and distance, allowing the surgeon to determine precisely how far a nerve is from the stimulus probe," says

Dr. Bartol.

They found MMG detected the presence of a nerve on average 1.2 seconds earlier than EMG, using approximately half the amount of stimulating current. Since electrical resistance is highly variable, depending on the conducting tissue, EMG monitoring systems may utilize currents as high as 200 mA. The MMG system in this study has a maximum current output of 6 mA, nearly 35 times less than comparable EMG systems.

"We found mechanomyography to be a more sensitive indicator for locating nerves," says Dr. Bartol. "We can, without looking, know within a millimeter or two where we are in relation to the nerve. By utilizing a system that requires less electrical current, we may be able to further decrease the risk of injury to our patients."

Dr. Bartol explains that further investigation is needed in human trials.

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