

## Innovative new surgery repairs phrenic nerve injury, restores breathing function



**Since January 2013, UCLA surgeons** have been performing an innovative new surgery to treat individuals suffering from breathing difficulties caused by phrenic nerve injury. UCLA is one of only two locations in the country offering this surgery, and is the only one in the Western United States.

The phrenic nerve, which originates from the C3-5 cervical spinal roots in the neck, travels through the chest between the heart and lungs to the diaphragm, which is the primary muscle involved in breathing. The phrenic nerve causes the diaphragm to contract, resulting in expansion of the chest cavity and inhalation of air into the lungs. It transmits signals from the brain and spinal cord that cause both voluntary, or conscious breathing, and involuntary breathing, such as during sleep.

Individuals with phrenic nerve injury experience difficulty breathing. Depending on the severity of the nerve injury, some may become winded after climbing a flight of stairs, while others may not be able to do something as routine as tying their shoes without experiencing breathing distress. Difficulty in breathing while lying down can interfere with sleep, causing insomnia in some patients. Other symptoms may include low energy levels, lethargy, headaches and blue-tinged lips or fingers.

### New hope for long-suffering patients

While nerve decompression and nerve transplants are commonly used to treat arm or leg paralysis, the procedure had not been applied to treat diaphragm paralysis until recently. Limited treatment options include nonsurgical therapy or diaphragm plication, a procedure that surgically tightens the diaphragm in an effort to improve breathing capacity. But neither of those treatments can restore normal function to the paralyzed diaphragm, and most patients are told by their physicians that they need to learn to live with the injury.

With the new nerve decompression and nerve transplant surgery, however, doctors have reversed diaphragm paralysis in the vast majority of those who have undergone the procedure. “These patients suffer tremendously and have had very few options,” says Reza Jarrahy, MD, associate clinical professor in UCLA’s Division of Plastic & Reconstructive Surgery. “We are offering hope to patients who previously really had no hope and were resigned to this debilitating illness.”

## Causes and diagnosis

Injuries to the phrenic nerve anywhere along its path can cause impaired breathing function. Some patients develop the injury after a major operation such as neck dissection for head and neck cancer, lung surgery, coronary bypass surgery, heart valve or other vascular surgery and thymus gland surgery. Sometimes scar tissue can form in the neck and compress the nerve. Injuries can also result from epidural injections or other types of nerve blocks, as well as chiropractic manipulation of the neck, which can disturb the roots of the spinal nerves.

There is no national database tracking phrenic nerve injury. However, UCLA doctors say that approximately 75 percent of the patients who have sought surgical treatment since the procedure was pioneered have been men. Statistically, men have more injuries, surgeries and chiropractic manipulation than women.

Often patients are misdiagnosed with other ailments such as pneumonia, or reactive airway diseases such as asthma. But diagnosis can be confirmed with an assessment that may include a chest X-ray, where one side of the diaphragm will appear higher than the other, a video study of the motion of the diaphragm while breathing or an EMG, which measures the amount of electrical activity in the diaphragm.

## Procedure has 80 percent success rate

During the three-hour operation, surgeons first assess the area of nerve damage or compression. If indicated, they will release the phrenic nerve from any surrounding scar tissue compressing it. If the nerve had been compressed for a long period of time, it is possible that freeing it up from whatever was pinching it may still not solve the problem. In that case, surgeons use a nerve graft, usually taken from the lower leg, to bypass the injured area. In some cases, surgeons can use a branch of the spinal accessory nerve — the nerve that provides activity to the trapezius muscles — to bypass the area of phrenic nerve impingement.

UCLA surgeons performed their first procedure in January 2013. Since the surgery was first developed, more than 100 patients nationwide have been treated with an 80 percent success rate. A preliminary study of those 100 patients has shown significant improvement in breathing after the surgery. In addition, patients reported a marked increase in their regular activities and an overall improvement in their daily lives.

## Participating Physicians

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