Korean J Anesthesiol 2012 August 63(2): 183-184
http://dx.doi.org/10.4097/kjae.2012.63.2.183

Phrenic nerve palsy after internal jugular venous catheter placement

Eun Jin Ahn, Chong Wha Baek, Hwa Yong Shin, Hyun Kang, and Yong Hun Jung

Department of Anesthesiology and Pain Medicine, College of Medicine, Chung-Ang University, Seoul, Korea

Central venous catheters are usually inserted to measure the central venous pressure or use as an administration route for fluid or medication. There are reports that complications, such as arterial puncture, pneumothorax, occur in approximately 15% of cases when inserting it [1,2]. Phrenic nerve palsy is a very rare complication attributed to central venous catheter insertion. It can be caused when inserting the catheter into the subclavian vein or internal jugular vein, as well as when venal puncture is attempted several times with a thick needle, and can also occur when the needle is inserted too deeply, directly injuring the nerves. We recently had a case of phrenic nerve palsy, which was discovered late and its cause suspected to be central venous catheter insertion.

The patient, a 75 year old female, underwent left nephroureterectomy for papillary urothelial carcinoma. At the time, there were no abnormalities in the preoperative physical examinations and laboratory tests including a chest x-ray. A central venous catheter was inserted through land mark guidance, by means of the anterior approach, into the right internal jugular vein [1]. There were no difficulties or specific events during the procedure. The operation proceeded without any complications, yet the chest x-ray taken on the same day after the surgery, indicated pulmonary congestion and atelectasis on the right lower lobe. Two days after the surgery, the central venous catheter was removed. The ABGA, performed on the third day post surgery showed pH 7.42, $PaCO_2$ 40.7 mmHg, and PaO_2 64.1 mmHg in room air and the chest x-ray showed no differences when compared to the one before. Ten days after the surgery, the patient was discharged with no specific symptoms and was advised to take deep breaths and cough.

Six months later, the patient visited the outpatient clinic with dyspnea, which began occurring a month prior without any other symptoms, such as coughing or sputum. Atelectasis in the right lower lobe was observed in the chest x-ray taken, which was similar to the chest x-ray from six months before. In the dynamic chest CT, the right diaphragm had risen and segmental atelectasis could be observed in the right middle and lower lobes. Both an electroneurography and electromyography were performed on the right upper and lower limbs under the suspicion of phrenic nerve palsy. The results showed an abnormal electrophysiological finding that suggested right cervical radiculopathy (C 4, 5, 7) and right phrenic neuropathy. The right median nerve, ulnar nerve, lower limb nerve, and left phrenic nerve, were all normal. In the Jolly test performed, in order to rule out abnormalities in the neuromuscular junction, no abnormal electrophysiological findings were observed. The patient did not complain of other symptoms in the upper or lower limbs, other than dyspnea. Also, with the exception of the history of central venous catheter insertion six months prior, there were no other causes for the phrenic nerve palsy, such as tumor or infection. Hence, the central venous catheter insertion was suspected as the most probable cause for the phrenic nerve palsy.

The patient complained of dyspnea continuously, so a diaphragm plication was performed. The pulmonary function test, performed nine days after the surgery, showed FVC 1,510 (67%) ml and FEV_1 1,030 (68%) ml, which had improved from

Corresponding author: Chong Wha Baek, M.D., Department of Anesthesiology and Pain Medicine, College of Medicine, Chung-Ang University, 224-1, Heukseok-1dong, Dongjak-gu, Seoul 156-756, Korea. Tel: 82-2-6299-2583, Fax: 82-2-6299-2585, E-mail: nbjhwa@naver.com

the pulmonary function test performed before the surgery with FVC 1,350 (60%) ml and FEV_1 950 (63%) ml. The dyspnea improved twelve days after the surgery, so the patient was discharged, and currently, six months after the final surgery, the patient has had no other problems.

Other than direct damage inflicted by the needle, phrenic nerve palsy can also occur from the nerve being pressed by blood clots, or, from a successfully inserted central venous catheter pressing against the phrenic nerve, which moves along the superior vena cava [3]. Phrenic nerve palsy can temporarily appear as a result of local anesthetics infiltrating the subcutaneous in an effort to reduce the pain of central venous catheter insertion in patients who are awake. Nerve damage can be accelerated in patients with diabetic polyneuropathy, since inflammation develops on the vessel that supplies blood flow to the phrenic nerve [3].

To reduce the rate of complication occurrences, such as phrenic nerve palsy, which occurs when inserting a central venous catheter, the indications for the central venous catheter insertion should be carefully considered first, and the practitioner should be well acquainted with the anatomic structures surrounding the central vein. Complications are mostly caused by inexperienced one in a difficult case of central venous catheter insertion. Especially, when an attempt on one side fails and is reattempted on the other side. It can lead to bilateral phrenic nerve injury requiring complicated treatments. When an ultrasound guide is used, although it is difficult to find small nerves like the phrenic nerve, nerve relationships can be known through the surrounding structures, such as muscles and blood vessels. By knowing these structural relationships, it is helpful in apprehending the location of the phrenic nerve. In summary, it is advised that ultrasound guidance is used, accompanied by the use of thin needles with careful concern of an expert. After inserting the catheter, as in the case of our patient, a chest x-ray showing an ascended right diaphragm can be mistaken for segmental atelectasis. As a result, it is always important to keep in mind the possibility of complications, and to also be well aware that careful observations and aggressive treatment should be administered according to the changes in the patient's state and chest x-rays.

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