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Recurrent Laryngeal Nerve Injury Caused by Computed Tomography-Guided Chemical Destructive Block of the Thoracic Sympathetic Chain: Case Report and Literature Review

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Background: As one of the various treatments for primary hyperhidrosis, chemical destructive block of the thoracic sympathetic nerve chain may cause postoperative complications such as recurrent laryngeal nerve injury, but this complication is rare in clinical practice.

Case Report: We found that one patient had symptoms of hoarseness and dysphonia after chemical damage to the thoracic sympathetic nerve chain, mainly occurring at high pitches. Combined with the patient's imaging data and video laryngoscope examination results, we considered that a recurrent laryngeal nerve injury had occurred on one side. Three months after the operation, the patient's symptoms of hoarseness were alleviated.

Conclusions: Although there is low probability of recurrent laryngeal nerve injury in chemical destructive block of the thoracic sympathetic chain, it still requires an experienced thoracic surgeon to perform precise operations under computed tomography guidance. Percutaneous radiofrequency thermocoagulation may greatly reduce the possibility of nerve injury caused by the fluidity of anhydrous alcohol, so it can be better applied in clinical practice.

Key words: Chemical destructive block, recurrent laryngeal nerve injury, thoracic sympathetic chain

BACKGROUND

Primary hyperhidrosis is a disease related to autonomic nerve dysfunction. The treatment options include video-assisted thoracoscopic sympathectomy, percutaneous radiofrequency thermocoagulation, and chemical destructive block of the thoracic sympathetic chain. One patient had recurrent laryngeal nerve injury after computed tomography (CT)-guided chemical damage to the thoracic sympathetic chain. The patient's symptoms of hoarseness were alleviated 3 months after the operation.

Case

A 24-year-old male patient was admitted to the hospital on December 7, 2020 because of "excessive sweating of hands for more than 5 years." For 5 years, the patient had developed hyperhidrosis in the palms of the hands without obvious inducement, and the amount was more than that of ordinary people. It was more obvious when the patient felt stressed, and it could be relieved by itself. The patient had no chills, fever, nausea, vomiting, chest tightness, shortness of breath, or other discomforts. Five years of repeated attacks seriously affected his life and study. Physical and laboratory tests were normal. Admission diagnosis was palmar hyperhidrosis.

Surgery was performed the day after admission. A chemical damage block of thoracic sympathetic nerve

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chain was performed under local infiltration anesthesia. After entering the room, the patient's vein was routinely opened. The patient was placed in the prone position, the T4 vertebral body was positioned by CT, and the puncture point was 3 to 4 cm on both sides of the median line. After skin preparation and draping were completed, the operator slowly inserted the needle from the puncture point under CT monitoring after local anesthesia, and the process was smooth. CT showed that the needle tip was located on the outer edge of the vertebral body and above the small head of the rib, so we considered the position was right (Fig. 1, Fig. 2). The operator injected one mL of air on each side first and then injected 0.2 mL of iohexol + 0.8 mL of 2% lidocaine for air-composite liquid contrast imaging. The injection resistance was moderate. CT imaging again showed that the needle tip position was accurate and the contrast agent was well distributed; the drug solution was distributed outside the parietal pleura and extended upward and downward around the intercostal space, the small head of the ribs, and the anterolateral margin of the corresponding vertebral body. After 5 minutes, the patient felt warm in both hands, affirming the position was accurate, and then he was given a one-mL injection of 95% anhydrous alcohol. After the treatment, the patient felt obvious warmth in both hands without bruising or paleness, indicating that the treatment was effective. Then the operator removed the puncture needle, applied a sterilized dressing to cover the puncture point, and turned the patient over to make him lie down. The patient was observed for 10 minutes and was returned to the ward on a flat car since he was not uncomfortable. On the first day after the operation, the perspiration of both palms was significantly improved, and his vital signs were stable without other discomfort. The patient was discharged on the third day after surgery.

On the third day after being discharged from the hospital, the patient showed symptoms of hoarseness and speech weakness, especially at high pitches, without dyspnea or other symptoms. Three months after the operation, the symptoms of the patient's weak articulation were relieved, but the patient still felt uncomfortable when he spoke. Combined with the patient's symptoms, postoperative CT imaging report (Fig. 3), and video laryngoscopy (Fig. 4), it was considered that the thoracic sympathetic chain block operation damaged the left recurrent laryngeal nerve and caused paralysis of the left vocal cord.

DISCUSSION

Primary hyperhidrosis (PH) refers to the excessive secretion of sweat glands in the hands that causes sweating and is not affected by external temperature. The

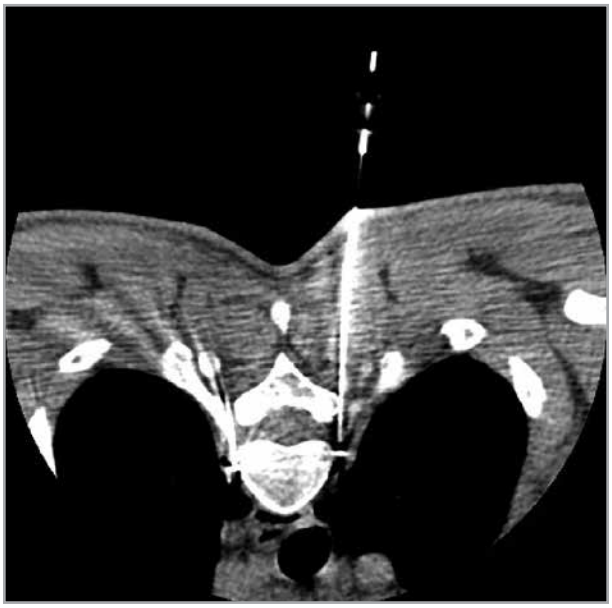

Fig. 1. Computed tomography (CT) examination of the patient's T4 plane during the operation.

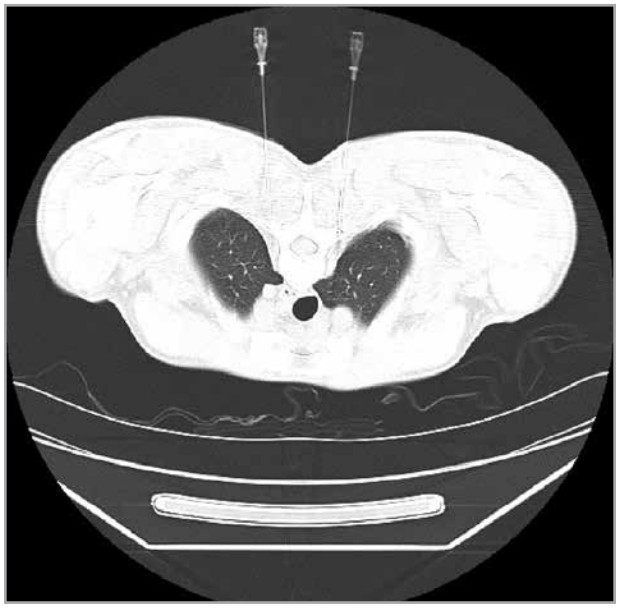

Fig. 2. Computed tomography (CT) examination of the patient's T4 plane during the operation.

pathogenesis is complicated and it is currently believed to be related to autonomic nervous dysfunction. The incidence rate in the population is about 0.5% to 3.0% (1). It usually occurs in children and adolescents, and has obvious family genetic tendencies. The symptoms tend to be obvious at the ages of 20 to 30. The disease does not affect health, but it often affects the patient's life, learning, and mental health due to excessive sweating of the hands, so active treatment should be chosen (2).

Throughout the treatment of hand hidrosis, thoracotomy was often required in the past. Since the 1940s, when Hughes et al (3) first performed thoracoscopic sympathectomy for the treatment of hand hidrosis, this procedure has been widely used in the treatment of hand hidrosis. This operation mainly blocks the conduction of sympathetic nerve excitation by blocking the T2, T3, and T4 ganglia, so as to achieve the purpose of treatment (4). Although compared with traditional thoracotomy, the introduction of endoscopic thoracic sympathectomy (ETS) surgery greatly reduces surgical trauma, but there is still the possibility of many complications such as pleural effusion, subcutaneous emphysema, bleeding, and Horner's syndrome. Compensated hyperhidrosis is also a common postoperative complication and this conundrum continues to perplex both surgeons and patients (5).

Percutaneous radiofrequency thermocoagulation is also a common method for the treatment of palmar hyperhidrosis. This method uses the thoracic dorsal percutaneous puncture approach to locate the sympathetic ganglia of the corresponding intervertebral vertebrae. The temperature is 90°C and the duration is 180 seconds. During the operation, we should observe the corresponding skin temperature and heart rate to check whether the treatment is effective. Garcia et al (6) believe that although the cure rate of radiofrequency thermocoagulation is lower than that of thoracoscopic sympathectomy, it is more cost-effective and has relatively fewer complications. In particular, the probability of postoperative compensatory hyperhidrosis is much lower than that of thoracoscopic sympathectomy, and they believe that radiofrequency thermocoagulation can be used as a safe, effective, economical, and reliable treatment for primary hyperhidrosis. It can be used as the first choice for patients with compensatory hyperhidrosis after thoracoscopic surgery.

This patient was treated with CT-guided anhydrous alcohol chemical block of the thoracic sympathetic nerve chain. The method is to perform a sympathetic ganglion block through the skin under CT guidance, and inject anhydrous alcohol into the sympathetic ganglia to make it coagulated and deactivated, so as to achieve the purpose of treatment. This method is not operated under direct vision and the positioning is not accurate each time. Bleeding, pneumothorax, etc. may occur, so it requires a skilled thoracic surgeon to perform it, and is not suitable for general use. At present, this method is mostly used for patients who relapse after endoscopic thoracic sympathectomy or who cannot be operated on due to severe adhesion of the pleura (7).

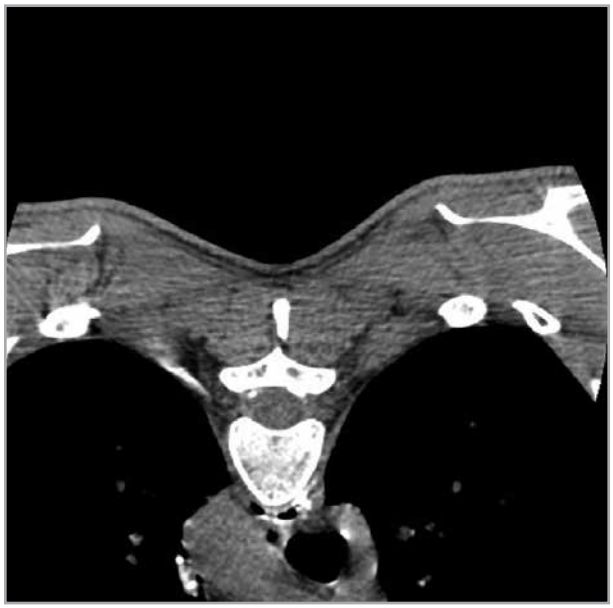

Fig. 3. Postoperative CT examination of the patient. Contrast agent flowed to the area of the left recurrent laryngeal nerve, indicating that the left recurrent laryngeal nerve was damaged.

Fig. 4. Postoperative video laryngoscopy showed paralysis of the left vocal cord.

The most common symptoms of unilateral recurrent

laryngeal nerve injury are hoarseness and weak vocalization, which can cause paralysis of the abductor and adductor muscles on one side. However, because the superior laryngeal nerve is still normal, the cricothyroid muscle can still maintain the function of abduction and adduction. The vocalization can often be improved after the function is compensated for by the contralateral vocal cords. The vagus nerve sends out the recurrent laryngeal nerve after entering the thoracic cavity. The left recurrent laryngeal nerve starts in front of the aortic arch, and after branching out from the vagus nerve, it closely adheres to the outer edge of the arterial ligament, bypasses the lower part of the aortic arch, runs along the trachea and esophagus groove, and enters the larynx behind the cricothyroid joint. The anterior branch is distributed in the adductor muscle, and the posterior branch is distributed in the abductor muscle. The right recurrent laryngeal nerve generally runs in front of the right subclavian artery and descends from the right vagus nerve. It circulates around the anterior and inferior part of this artery and then turns upwards. It travels upwards along the groove between the upper respiratory tract and the esophagus, and enters the larynx after reaching the cricothyroid joint. Consider that on the one hand, the left recurrent laryngeal nerve on the T4 plane is anatomically close to the puncture and the anhydrous alcohol injection site; on the other hand, coupled with the fluidity and permeability of the injected drug solution, the target area is enlarged or shifted, resulting in hoarseness and speech weakness in the patient due to the injury of one side of the recurrent laryngeal nerve. The CT results after the operation showed that the left recurrent laryngeal nerve area was highlighted, and the contrast agent had been distributed around the left recurrent laryngeal nerve; this provided further evidence that the dehydrated alcohol chemically damaged the recurrent laryngeal nerve at the puncture plane, leading to the corresponding symptoms of the patient.

In addition to considering the fluidity of the liquid medicine, the fact that this operation is not conducted under direct vision may also be an important reason for the patient's complication. Although the CT-guided puncture operation can be accurate to the millimeter level, which greatly improves the puncture accuracy, the random tool ruler of CT can only help provide specific puncture points, puncture depths, and angles. In actual operation, the operator still needs to rely on experience and the parameters provided to pierce. During the process of puncture, several scans are needed to correct the direction and depth of the puncture needle. This not only increases the number of attempts, which increases the patient's tissue damage, but also increases the patient's radiation exposure, prolongs the operation time of puncture, and also increases the possibility of nerve damage caused by the liquid.

When recurrent laryngeal nerve injury occurs, the duration of postoperative follow-up is determined by the intensity of the symptoms and the results of the physical examination. If the voice is easily fatigued and the patient has symptoms, he will be sent to a speech therapist. In addition, some patients are also sent to ENT doctors who specialize in the treatment of voice disorders (speech pathologist, phoniatrician, specialist in phoniatrics). If the paralysis/paralysis lasts more than one year, and if the patient still has symptoms, surgical treatment will be provided (cord medialization or resection of an arytenoid cartilage) (8). This patient's postoperative follow-up included video laryngoscopy once a month to observe whether the patient's hoarseness had improved. At present, the patient's hoarseness has improved greatly.

CONCLUSIONS

This article is only a single case report. Due to the low incidence of recurrent laryngeal nerve injury after surgery, it is necessary to expand the sample for long-term observation in the future. In addition to the operation of skilled and experienced operators, other methods such as percutaneous radiofrequency thermocoagulation may greatly reduce the possibility of nerve damage caused by the fluidity of absolute alcohol and thereby achieve the purpose of reducing the occurrence of this complication.

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