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Case Report

Otitic Barotrauma Causing Facial Baroparesis

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Abstract

Facial baroparesis is an extremely rare clinical entity which occurs due to otitic barotraumas. It is rarely reported in medical literature which can happen among persons those ascend to high altitude in flight or scuba diving. The overpressure in the middle ear cavity due to eustachian dysfunction may cause exertion of the excessive pressure over the facial nerve through a dehiscence of the horizontal segment of the fallopian canal leading to facial nerve paralysis. The clinical history and imaging help to diagnose this rare cause of facial nerve paralysis. Here, we report a case of a 38-year-old female who experiences unilateral facial nerve paralysis on ascent to high altitude on a flight, with relieve from symptoms shortly after descent.

Keywords: Eustachian tube dysfunction, facial baroparesis, facial nerve, otitic barotrauma

Introduction

Facial baroparesis is facial nerve palsy due to transient hypoxemia of the seventh cranial nerve secondary to raised pressure in the middle ear cavity. It is often reported in pilots or divers due to development of the high pressure in middle ear cavity.[1] This may be due to impaired function of the eustachian tube. There are certain conditions which narrows the lumen of the eustachian tube such as edema, raised viscosity of the mucus coating of the tubal mucosal membrane or impairment of the tube to open.[2] The facial nerve passes through the temporal bone via fallopian canal. This fallopian canal is a complicated bony pathway which is affected by the pressure changes. The development of the high pressure in the tympanic segment of the facial nerve may cause temporary ischemic neuropraxia which is thought to be the cause of the facial nerve palsy.[3] The facial nerve palsy can be relieved by equalizing the pressure in the middle ear cavity through nasopharynx through eustachian tube. We report a case of baroparesis in 38-year-old female who developed transient facial nerve paralysis while travelling on a commercial flight.

Case Report

A 38-year-old female attended the outpatient department of the Otorhinolaryngology with right side facial weakness [Figure 1] since 3 days. He had a history of travel through flight where she developed facial weakness. She had increased sensation of pressure in his ears during ascent of the flight, but failed to relieve even after doing yawning or chewing gum or Valsalva. During maximum elevation, she felt tingling sensation on the right side of the face and felt numbness over the face along with mild headache. The flight attendant helped with mid-air emergency service. The patient vitals such as blood pressure, pulse rate, and respiratory rate were within normal limits. During descent of the flight, she felt little comfortable and leading to near complete resolution of the symptoms. However, the facial weakness in the right side persisted, so attended our outpatient department. She had a history of upper respiratory tract infection along with nasal congestion and cough for 3 weeks prior to flight. She had no addiction to tobacco and alcohol. Examinations of ear and nose were unremarkable.

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All the cranial nerves were within normal limits except facial nerve which showed facial asymmetry with Grade-II House–Brackmann facial nerve palsy in the right side. The sensory, motor coordination, and reflexes were within normal limit. Noncontrast computed tomography (CT) scan of head, CT angiography of the head and neck and magnetic resonance imaging with and without contrast of her head and neck were done. CT scan of the temporal bone showed dehiscence of the tympanic segment of the facial nerve [Figure 2]. All imaging of the patient were within normal limit. Routine laboratory blood tests such as total white blood cell counts, platelet, erythrocyte sedimentation rate, blood glucose, lipid profile, serum creatinine, serum sodium, and potassium were also within normal limits. The patient was treated with nasal decongestants and antihistamines for upper respiratory tract infections. The facial weakness was completely subsided after 1 week of treatment [Figure 3].

Figure 1: Patient presenting with right side facial baroparesis

Figure 2: Computed tomography scan of the temporal bone showing dehiscence of the tympanic segment of the fallopian canal

Figure 3: Complete recovery of the facial baroparesis

Discussion

Otitic barotrauma is a rare clinical entity which occurs due to eustachian tube dysfunction because of the inability to equalize the pressure difference across the tympanic membrane. The middle ear cavity is an air filled space where the pressure equalization occurs through the nasopharynx via eustachian tube. Eustachian tube dysfunction will greatly affect the pressure of the middle ear cavity. The eustachian tube dysfunction often leads to hampering the pressure equalization of the middle ear with outside environment, which causes otitic barotrauma. This otitic barotrauma may cause transient facial nerve paralysis due to unilateral development of high pressure in the middle ear cavity during ascent to high altitude in aeroplane. As the aeroplane ascents, the atmospheric pressure reduces and gas in the middle ear cavity expands as per Boyle's law.[4] However, in modern aircraft, the cabin pressure is maintained to air pressure of approximately three-quarters of the ground atmospheric pressure corresponding with an altitude of 8000 feet.[4] If a flight begins at sea level, the maximum pressure difference occurs between the middle ear cavity and cabin atmosphere is around 261 mBars. This amount of the pressure will exceed the capillary blood pressure.[5] Excessive pressure in the middle ear is exerted to the facial nerve through dehiscence of the tympanic segment of the facial nerve or pressure over thin bony canal of the facial nerve in middle ear is thought to compress the vasa nervorum. The high pressure in middle ear which is exerted on the exposed facial nerve may lead to relative hypoxia and temporary neuropraxia.[6] Facial nerve has a complex and tortuous course in the temporal bone. The etiopathology behind facial baroparesis can be easily explained on the basis of its anatomical course. After leavening from pontomedullary junction, facial nerve traverses the cerebellopontine angle prior to enter into the temporal bone through the internal auditory meatus. After crossing the internal auditory canal, it travels through the fallopian canal, which is subdivided into labyrinthine segment, tympanic segment, and mastoid segment. Then, the facial nerve exits the skull through the stylomastoid foramen, traverse the parotid gland and give rises to five terminal branches which innervate the muscles of facial expression.[7] The widely accepted explanation for facial nerve baroparesis is hypoxemia or ischemic neuropraxia seen

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at the horizontal or tympanic segment of the facial nerve. The tympanic segment of the facial nerve crosses the middle ear just medial to the incus where the facial nerve and middle ear cavity are separated by a very thin bony layer. In approximately 55% cases of the normal population, spontaneous dehiscence of the tympanic segment of the fallopian canal is seen in CT scan leading to direct exposure of the nerve to the middle ear.[8] In our case, CT scan of the temporal bone showed dehiscence of the tympanic segment of the fallopian canal.

Reaching to high altitude make low pressure in the cabin of the aeroplane, i.e., cruising to altitude of 35,000 feet, make lowering the cabin pressure and estimated to as high as 266 cm of water, the pressure which can be easily overcome by capillary hydrostatic pressure.[9] Increased pressure in the middle ear cavity at high altitude is directly transmitted to the tympanic segment of the facial nerve, leading to temporary ischemic neuropraxia. The neuropraxia often transitory and resolves between 3 min and 3 h.[10] However, there is long lasting even permanent facial nerve paralysis reported in medical literature.[11] This case of facial nerve palsy was for transitory period. This may cause temporary facial nerve palsy which will be relieved once pressure from middle ear is relieved after equalization of the middle ear and outside environmental pressure.[12,13] If patient with eustachian dysfunction will fly to high altitude, he or she may suffer from otalgia with lead to facial nerve palsy. These symptoms may be disappeared swiftly on descent. These patients are usually asymptomatic before and after flight. In our case, the patient was presenting with fullness in the ear and facial weakness. Clinical examinations often show bulged tympanic membrane at the affected ear. Neurological examination or cranial nerve examination confirms the facial nerve paralysis. Hearing assessment is done to assess the cochlear functions. Vestibular examination may be associated with abnormal vestibular tests. CT scan of the temporal bone is useful to assess the status of the middle ear cavity and fallopian canal. Congenital dehiscence of the facial nerve canal of the temporal bone is responsible for causing facial baroparesis in middle ear barotrauma.[14] In this case, there was exposure of the facial nerve in the tympanic segment of the fallopian canal. For preventing this type of the facial nerve palsy, the patient should be instructed for using nasal xylometazoline spray in both nostrils before ascent in flight. The patient is also instructed for doing Valsalva maneuver or Toynbee maneuver for getting patent eustachian tube. If facial nerve palsy persists after flight, the patient should be advised for direct medical consultation. In case of long standing facial baroparesis, immediate myringotomy with grommet insertion is performed to prevent permanent damage of the facial nerve. Oral steroids can be prescribed in case of persistent facial baroparesis.

Transient facial baroparesis is a rare complication of barotrauma in airline travelers. It is an under-reported clinical entity. We should encourage reporting more cases to better understanding and management of this rare clinical condition.

Conclusion

Facial baroparesis is an uncommon cause of facial palsy. It is seen among air travelers or pilots and divers and often temporary in nature. The most accepted pathogenic mechanism for this facial palsy is ischemic neuropraxia. Although it is uncommon, emergency physicians should think about the facial baroparesis as a complication of eustachian dysfunction. Accurate history taking, history of flying or diving will help to get diagnosis of facial baroparesis. Symptoms are usually resolved after equalization of middle ear and ambient pressure of the environment.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient (s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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