

Facial paralysis during air travel: case series and literature review

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Abstract

Objective: We report three cases of recurrent, unilateral facial palsy associated with air travel.

Method: The three cases are presented, along with a brief literature review concerning barotrauma and its association with air travel and facial palsy.

Results: All three patients experienced unilateral facial paralysis during air travel, accompanied by additional symptoms which varied between cases. Symptoms resolved spontaneously in all cases. Two patients received ventilation tube insertion to prevent further recurrence. Computed tomography scanning revealed no bony defect in two patients, while the third exhibited dehiscence of the facial canal which may have contributed to the condition.

Conclusion: Available evidence suggests that eustachian tube dysfunction can contribute to increased pressure within the middle ear, leading to neuropraxia of the facial nerve. Cases of facial paralysis associated with air travel are under-reported. Since there is no evidence-based management protocol for this condition, further investigation of its pathology is encouraged in order to improve our understanding.

Key words: Barotrauma; Aviation; Facial Paralysis; Pathophysiology

Introduction

Otitic barotrauma results from insufficient pressure equilibration across the tympanic membrane, and is typically associated with pressure variations experienced during flying and diving. The eustachian tube connects the middle ear with the nasopharynx. Frequent opening of the eustachian tube by contraction of the salpingopharyngeus and tensor veli palatini muscles, as seen during swallowing, permits equalisation of middle-ear pressure.^{1,2}

Neuropraxia of the facial nerve in a dehiscence bony canal has been attributed to significant pressure changes occurring during air flight or underwater diving, in patients with eustachian tube dysfunction. This may lead to temporary facial paresis, earache, hearing loss and dizziness.^{2,3}

We carried out a Medline search using the key words 'barotrauma', 'facial palsy' and 'aviation', in order to review the literature from 1966 onwards.

A number of cases of facial paralysis associated with scuba diving have been reported.^{4–7} The facial palsy was preceded by ear pain and hearing loss. However, facial palsy associated with air travel is less common, with unilateral facial palsy usually the only symptom.^{8,9} This tends to resolve within 20 to 30 minutes of onset, or promptly following descent. A case of facial palsy from high altitude mountain walking has been described.³

Steroids, ventilation tube insertion and surgical improvement of the nasal airways have been reported in order to reduce recurrent problems.^{3,7,8}

We present three cases of facial palsy associated with air travel, highlighting the variation in presentations. The

widespread popularity of airline travel makes familiarity with this condition important.

Case reports

Case one

A 23-year-old woman attended Ninewells Hospital, Dundee, in April 2003 complaining of left-sided tinnitus and facial weakness, first experienced when she was a passenger on an aircraft on a long-haul flight. Her husband, a physician, had noted facial weakness and drooling. The weakness had resolved soon after onset, but she had also experienced facial pain and persistent tinnitus (a constant, loud, low-pitched, hissing noise). She denied any hearing loss or vertigo. She had no nasal symptoms. There was nothing contributory in her past medical history.

No abnormality was found on clinical examination, including neurological examination and naso-endoscopy, five days following the paralysis.

Pure tone audiography showed normal thresholds between 250 and 8000 Hz in both ears. Impedance testing showed no abnormalities.

A magnetic resonance imaging (MRI) scan of the brain was normal.

By July 2003, the tinnitus was no longer bothersome. However, the patient developed left-sided hyperacusis, and had a short dizzy spell between January and July 2004.

In July 2006, she reported a further episode of left-sided facial weakness during a flight, this one lasting six minutes and leaving her with facial pain persisting for several hours.

Her hearing remained normal. She was pregnant at the time, so a computed tomography (CT) scan of the temporal bones was delayed until May 2007. This showed that both facial nerves followed a normal course; however, on the left there was dehiscence of the horizontal portion of the facial canal.

Case two

A 62-year-old man attended Ninewells Hospital in December 2005 complaining of left-sided tinnitus. He had experienced left facial weakness during a short flight in a low-pressure aircraft. The weakness had lasted approximately two hours and had been associated with feelings of pressure and some pain. He had no nasal symptoms.

On examination, the patient had bilateral external auditory canal exostoses, with the tympanic membrane clearly visible and normal. Neurotological and naso-endoscopic examinations were normal.

Pure tone audiography showed bilateral, mild, high frequency hearing loss. Impedance testing was normal.

An MRI brain scan was also normal.

In May 2006, the patient had another episode of left facial palsy during a long-haul flight, this one associated with symptoms of pressure, pain and weakness, which resolved. He was due to fly again and was concerned about recurrence, so sought medical advice.

A CT scan was scheduled, and a ventilation tube was inserted into the left tympanic membrane under local anaesthesia. The CT showed the facial nerve to be normal with no bony defect.

Following this, the patient flew on four occasions, two on long-haul flights, and experienced no pressure or facial palsy symptoms.

Case three

A 27-year-old man attended Aberdeen Royal Infirmary in December 2010 after experiencing right-sided facial palsy on three occasions. All these episodes had occurred while

travelling on a commercial aircraft. A feeling of pressure in his right ear had been followed by pain in that ear, while the left ear had felt normal. His earache had improved after approximately 15 to 30 minutes, but had been followed by tongue numbness and right-sided facial weakness. He had felt unable to blink his right eye or to move his right facial muscles. His partner had taken photos of his face, shown in Figure 1. On the first occasion, the symptoms had resolved after 45 minutes, at which point he had felt that the pressure equalised in his ears. On subsequent occasions, during flight, his face had begun to feel slightly numb, but early equalisation of pressure had occurred before facial weakness developed.

On review in the clinic, no ear abnormality was noted and there was no residual facial palsy.

A CT scan of the temporal bones was normal, with no obvious dehiscence identified.

After mutual discussion and agreement, a ventilation tube was inserted into the patient's right ear under local anaesthesia.

Subsequently, the patient flew twice but remained symptom-free.

Discussion

Facial nerve palsy is a rare complication of otitic barotrauma. The three cases described largely concur with previously reported cases of facial palsy during flight.

The generally reported experience is of a period of facial weakness, experienced at high altitude, which resolves after a period ranging from approximately 30 minutes to a few hours, and is associated with symptoms such as facial pain, facial numbness, ear discomfort, a sensation of pressure, and tinnitus. While the three patients described above did not report hearing loss, this was an associated symptom in previous reports of facial palsy experienced at altitude and during diving.^{3,7–10}

The atmospheric pressure at sea level is 760 mmHg. Commercial aircraft cabins are pressurised to the equivalent of an altitude of 1500–2500 m.^{11,12} This creates a potential

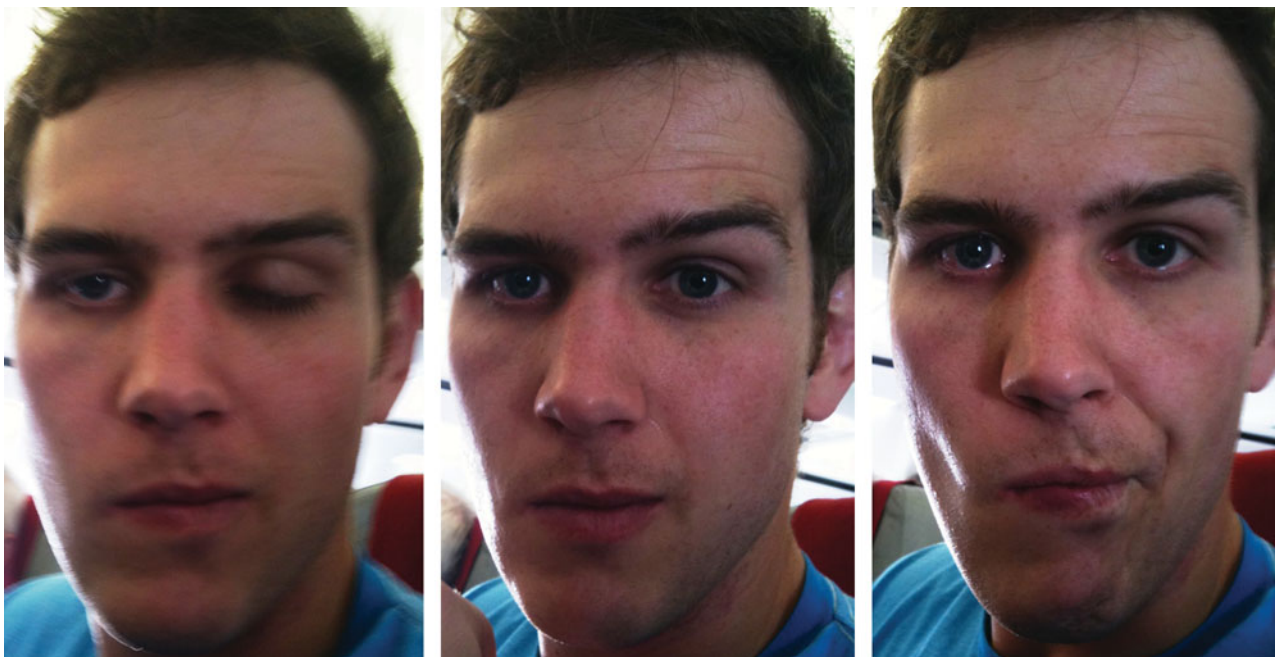


FIG. 1

Photographs of case three showing facial paresis experienced during air travel. Published with patient's permission.

pressure gradient across the tympanic membrane, which must be equalised by normal, passive opening of the eustachian tube.^{1,2}

Infections of the nose (e.g. acute rhinitis) or deviation of the nasal septum may be associated with eustachian tube dysfunction which can lead to barotrauma.^{7,8} Indeed, one previous report of five cases noted facial baroparesis in divers who descended while suffering from 'common cold' and who had trouble equalising their middle-ear pressure.⁴ The eustachian tube can also be congenitally blocked, but whether this leads to barotrauma is not clear.¹³

Development of a pressure gradient across the tympanic membrane may lead to compression of the facial nerve and, as the bony facial canal has been found to be dehiscence in over 50 per cent of cases, the nerve can be vulnerable to neuropraxia.¹⁴ When the eustachian tube is impaired and unable to open, a decrease in outside pressure, such as during ascent in an airplane, raises the pressure within the middle ear.¹² It is unclear whether this can cause significant compression of the facial nerve leading to facial paresis, but it has been suggested as a causative mechanism, based on the quick onset and resolution of facial paresis in reported cases.¹⁵ Dehiscence of the bony facial canal is relatively common in adults. The highest prevalence occurs in the tympanic segment of the facial nerve, near the region of the oval window. The reported incidence of dehiscence varies greatly, ranging from 1 to 74 per cent. In cadaver and temporal bone studies, dehiscence rates of between 10 and 74 per cent have been reported.^{16–19} Computed tomography detection of facial canal dehiscence has a sensitivity of 66–66.6 per cent and a specificity of 84–98 per cent.^{20,21}

Hence, it could be hypothesised that our second and third cases did actually have microdehiscences of the fallopian canal on the side of the development of their palsy, which were not obvious on their CT scans. This hypothesis is based on the present understanding that barotrauma in association with bony fallopian canal dehiscence is the most likely explanation for the observed facial palsy, despite the fact that two of our three patients had intact bony canals evident on their CT scan.

- Facial nerve neuropraxia can cause facial palsy during flight and diving
- Bony facial canal dehiscence plus barotrauma is a common explanation
- Three cases are reported, two with an intact facial canal, indicating a multifactorial cause

However, as both air travel and facial canal dehiscence are common, and facial palsy during flight is rare, the cause could be multifactorial. If the middle-ear cavity is unable to communicate with the upper airway and thus to equalise its pressure, injury is likely to occur. Depending on its magnitude, the pressure difference can cause mucosal oedema, contusion, haemorrhage, and possibly even nerve compression or herniation (if the bony canal is dehiscence).³

Conclusion

Transient facial paresis is a rare complication of barotrauma in airline travellers. It is likely to be under-reported. Our literature review indicated that there is currently no evidence-based management protocol for this condition. Insertion of

ventilation tubes seems to be beneficial. We would encourage the reporting of more cases in order to increase our understanding and management of this rare condition.

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