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GRAND ROUNDS

Permanent twelfth nerve palsy secondary to C0 and C1 fracture in patient with craniocervical pneumatisation

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Abstract

Introduction Craniocervical pneumatisation of both occiput and upper cervical vertebrae is extremely rare. Although it was stated that hyperpneumatisation can lead to fracture, only few cases of such injuries have been reported. Generally, craniocervical fractures represent a small number of cervical spine injuries and they are usually caused by high-energy trauma and can be associated with lower cranial nerves palsy.

Case report We present here a case of healthy man with mostly left sided pneumatisation of occiput and C1 who suffered from fractures of occipital condyle and posterior arch of C1 associated with permanent hypoglossal nerve injury. Both fractures were stable and he was treated conservatively with a rigid collar.

Conclusion At follow-up, the patient reported no pain and no restriction in head movement. Total hypoglossal nerve palsy remained unchanged. Conservative treatment is a method of choice in such cases.

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Keywords Hypoglossal nerve injury · Condylar fracture · Cranial pneumatisation · Mild brain injury

Case presentation

A 72-year-old healthy man was involved in a collision with a bike and sustained a minor head injury after the fall onto pavement. He was admitted to accident and emergency department with dysarthria and neck pain. The neurological examination showed left hypoglossal nerve palsy without any associated neurological deficit in both upper and lower limbs. Plain films radiograph revealed pneumatisation of the occipital bone and C1 (Fig. 1). CT of head and cervical spine showed extensive craniocervical pneumatisation with continuous aeration from both mastoid processes into the occiput and through the left condyle into the atlas (Figs. 2, 3) and two fractures with collateral soft tissue emphysema: compressive fracture of the left occipital condyle with narrowing of the hypoglossal canal (Figs. 4, 5) and fracture of the posterior arch of C1 (Fig. 5). MRI of brain and cervical spinal cord was normal. He was treated conservatively with hard neck collar.

Historical review of the condition, epidemiology, diagnosis, pathology

Pneumatisation of middle ear and perilabyrinthine air cell is consistent, while development of mastoid and petrous bone aeration can vary greatly. Cranial hyperpneumatisation usually affects men and the most commonly quoted

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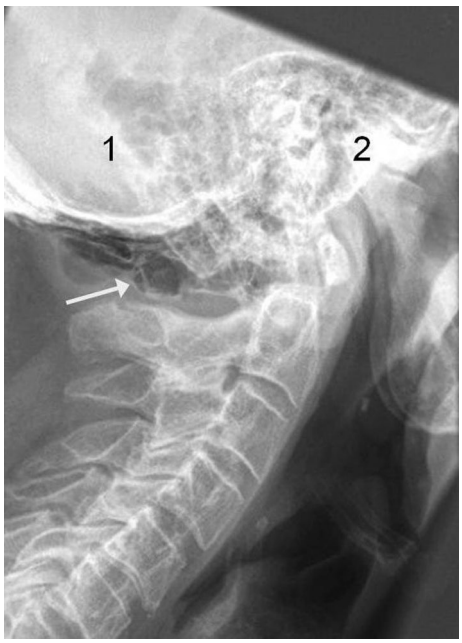

Fig. 1 Lateral X-ray of head and cervical spine showing pneumatisation of occipital (*1*) and temporal bone (*2*) and C1 vertebra (*arrow*)

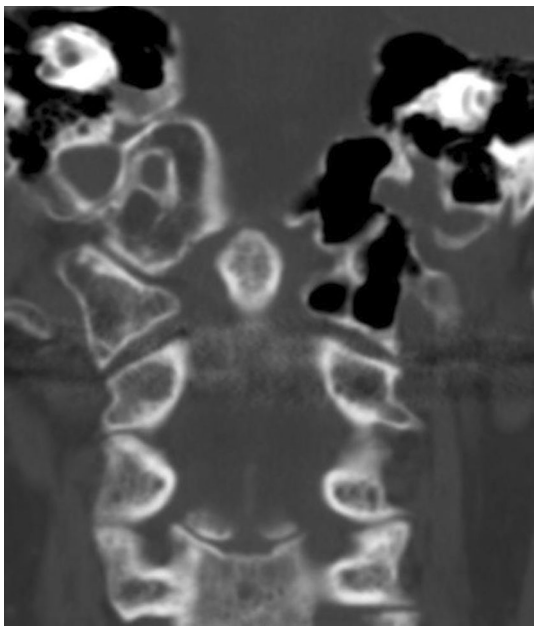

Fig. 2 Frontal CT reconstruction showing pneumatisation of the C0–C1 region on the left side

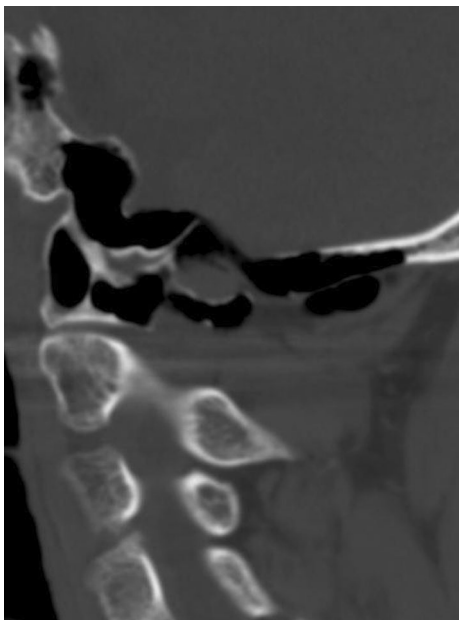

Fig. 3 Sagittal CT reconstruction

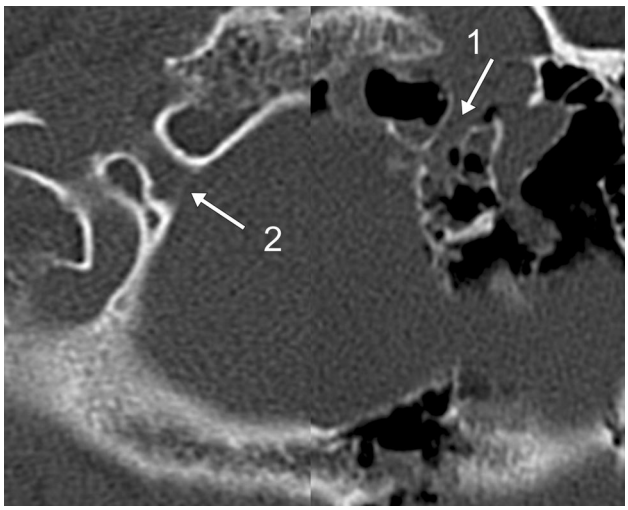

Fig. 4 Axial CT scan of occipital bone showing compressive fracture of the pneumatised condyle on the left side with narrowing of the hypoglossal canal (*1*) and normal hypoglossal canal on the right side (*2*). The figure is a composite of two slices from different levels due to oblique sections

theory for its cause is a ball valve mechanism where air forced up the Eustachian tube is trapped and gradually leads to enlargement of the sinuses with extension into the occiput. Extensive coughing, recurrent high-altitude travel [1], recurrent Valsalva maneuvers [2], frequent scuba diving [3] or weightlifting [4] can trigger this mechanism. In more severe cases like in our patient, the aeration can surpass atlanto-occipital joint and continue to C1 or rarely to C2 [5]. Littrell et al. described a case of a man with craniocervical pneumatisation which extended into the epidural space causing mass effect on the parietal lobe [6]. It was stated that hyperpneumatisation can lead to pathological bone fracture. However, only a few such cases have been published yet. Although spontaneous subcutaneous emphysema was described in the literature [7], we think that in our case, emphysema was associated with both fractures due to its absence after bone healing (Fig. 6).

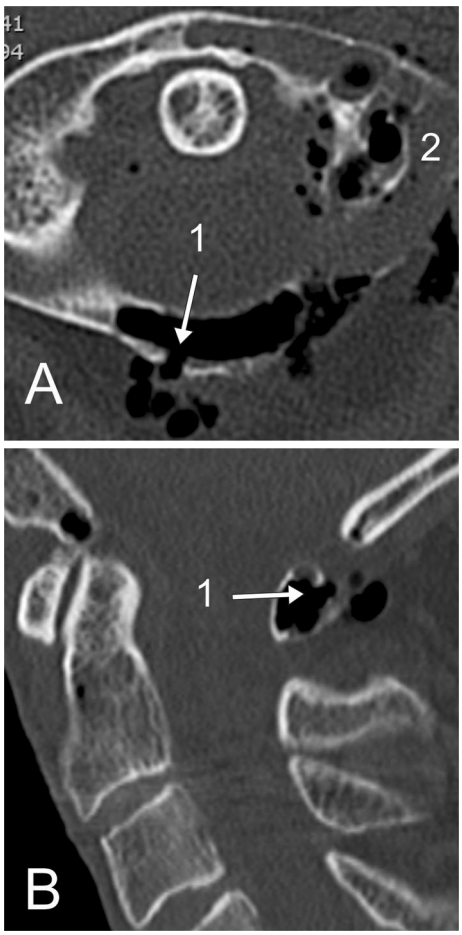

Fig. 5 Axial (**a**) and sagittal (**b**) CT scan showing fracture of the posterior arch of C1 (*1*) with collateral soft tissue emphysema. (*2*) left occipital condyle

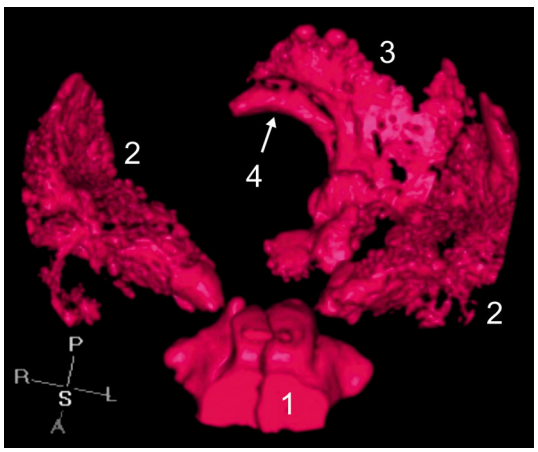

Fig. 6 CT-3D reconstruction of the skull base pneumatisation 1 year post-injury. *1*—Sphenoidal sinus, *2*—Temporal bones, *3*—Occipital bone, *4*—C1 vertebra

Occipital condyle fracture is not commonly seen in clinical practice, often being associated with fatal trauma. Its incidence in trauma population is 0.4 %. Maserati et al.

Fig. 7 Photography showing left-sided hemiatrophy of the tongue 4 years post-injury

found only 106 cases in a group of almost 25,000 traumatic patients. Neural element compression was not identified in any of the patients [8]. Jin et al. described 6 cases of 12th nerve palsy in 312 patients after traumatic brain injury. Four of them died [9]. Caroli et al. found in their largest review that early or delayed involvement of lower cranial nerves was present in 43 (40 %) patients. The most commonly involved nerve was 12th nerve (74 % of all cases). It is due to fracture extension through the hypoglossal canal. Only five patients suffered from permanent total palsy. Because of the proximity of the jugular foramen to the occipital condyle, 9th–11th nerves can be injured too [10]. Atlas fractures represent 15 % of cervical spine injuries and are usually caused by high-energy trauma. The diagnosis of craniocervical fractures can be made with a CT scan with sagittal and coronal reconstructions. An MRI may be considered to evaluate the ligamentous status of the atlanto-occipital joint and possible concomitant brain and spinal cord injury [11].

The only similar case report published by Renard et al. described a scuba diver presented with hypoglossal nerve palsy 2 days after occipital head trauma. CT showed excessive craniocervical pneumatisation and right-sided condylar fracture. In contrast to our case, the hypoglossal nerve palsy resolved spontaneously 10 days after injury [3]. Moreover, our patient has never had inflammation or surgery of the middle ear and he has had no history of above-mentioned trigger mechanisms which could cause dysfunction of Eustachian tube.

Rationale for treatment and evidence-based literature

Surgical decision making for both condylar and atlas fractures is based on stability and possible concomitant

ligamentous injury, respectively [11]. According to Tuli et al. classification, our patient suffered from Type I condylar fracture [12]. Both this fracture and fracture of posterior arch of C1 are stable and can be successfully treated with external immobilisation [11]. The prognosis of traumatic 12th cranial nerve palsy is generally poor and there is no report about decompression treatment for low cranial nerve injury in the literature [9]. Our patient was treated conservatively with a rigid collar.

Outcome, follow-up

At 12-month follow-up, the patient reported no pain and only minimal restriction of cervical motion. CT showed reabsorption of the soft tissue emphysema (Fig. 6). After four years, total hypoglossal nerve palsy with left-sided hemiatrophy of the tongue is evident (Fig. 7). He is still complaining of dysphagia, while dysarthria resolved spontaneously. He has no restriction in head movement.

Conflict of interest None.

References

1. Rochat P, Madsen C, Christensen JK (1997) 'Flight-induced' neurological symptoms due to undiagnosed craniocervical bone pneumatization. Acta Neurochir 139(12):1187–1188
2. Quigley AJ, Shannon H (2013) Craniocervical pneumatization. J Radiol Case Rep 7(8):27–33
3. Renard D, Freitag C, Castelnovo G (2012) Mystery case: hypoglossal nerve palsy in occipito-temporal pneumatization. Neurology 79(13):e109–e110
4. Germino JC, Medverd JR, Nguyen VT, Favinger JL, Marder CP (2013) Craniocervical hyperpneumatization with concurrent pneumorrhachis, pneumomediastinum, and subcutaneous emphysema in a weightlifter. Spine J 13(10):e47–e53
5. Massmann A, Garcia P, Pizanis A, Roth C, Nieder C, Schneider G, Bücker A (2012) Atypical extensive extratemporal hyperpneumatization of the skull base including the cervical spine: case report and review of the literature. Spine 37(3):E199–E202
6. Littrell LA, Leutmer PH, Lane JI, Driscoll CLW (2004) Progressive calvarial and upper cervical pneumatization associated with habitual valsalva maneuver in a 70-year-old man. Am J Neuroradiol 25(3):491–493
7. Moss M, Biggs M, Fagan P, Forer M, Davis M, Roche J (2004) Complications of occipital bone pneumatization. Australas Radiol 48(2):259–263
8. Maserati MB, Stephens B, Zohny Z, Lee JY, Kanter AS, Spiro RM, Okonkwo DO (2009) Occipital condyle fractures: clinical decision rule and surgical management. J Neurosurg Spine 11(4):388–395
9. Jin H, Wang S, Hou L, Pan C, Li B, Wang H, Yu M, Lu Y (2010) Clinical treatment of traumatic brain injury complicated by cranial nerve injury. Injury 41(9):918–923
10. Caroli E, Rocchi G, Orlando ER, Delfini R (2005) Occipital condyle fractures: report of five cases and literature review. Eur Spine J 14(5):487–492
11. Joaquim AF, Patel AA (2011) Craniocervical traumatic injuries: evaluation and surgical decision making. Global Spine J 1(1):37–42
12. Tuli S, Tator CH, Fehlings MG, Mackay M (1997) Occipital condyle fractures. Neurosurgery 41(2):368–376