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Intracranial hypotension in a young male patient associated with shoulder injury

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Intracranial hypotension is a rare condition with a wide range of symptoms. Typically, it is characterized by postural headaches, rarely by coma. Severe cases can be life-threatening. In most cases, intracranial hypotension is caused by repeated lumbar punctures or is spontaneous. Here, we present a case in which intracranial hypotension was associated with shoulder injury and brachial plexus injury.

Key words: brachial plexus injury, coma, cerebrospinal fluid leakage, overdrainage, intracranial hypotension.

Intrakraniální hypotenze u mladého muže v souvislosti s poraněním ramene

Intrakraniální hypotenze je relativně vzácná jednotka projevující se širokou škálou příznaků. Typicky je charakterizována posturálními bolestmi hlavy, vzácně též kómatem. Těžké případy mohou být život ohrožující. Ve většině případů je intrakraniální hypotenze způsobena opakovanými lumbálními punkcemi nebo je spontánní. V této kazuistice popisujeme případ, kdy intrakraniální hypotenze byla spojena s traumatem ramene s poraněním brachiálního plexu.

Klíčová slova: brachiální plexus, kóma, intrakraniální hypotenze, únik mozkomíšního moku.

Introduction

Intracranial hypotension (IH) is a rare condition characterized by a spectrum of neurological symptoms, including postural headaches or, in very rare cases, coma. Severe cases are potentially life-threatening. It is typically associated with the spontaneous leakage of cerebrospinal fluid (CSF) or is a sequela to repeated lumbar punctures [1–3]. Notably, over the past decade, only two documented cases have reported intracranial hypotension resulting from trauma with no connection to postoperative CSF leakage [4]. To our best knowledge, other reported cases involved head or vertebrae injury. We would like to present a unique case in which intracranial hypotension was associated with a shoulder injury and presented solely as a coma.

Case report

A 24-year-old male was admitted to a trauma centre after a motorcycle accident involving a collision with a traffic sign, resulting in a right shoulder injury. Initial evaluation by emergency services showed a paralysis of the right arm only, and the patient was fully conscious. Upon admission, a whole-body computed tomography scan (CT) was performed, revealing a single fracture of the right collarbone, with no signs of head or spine injury.

Two hours later, the patient fell into a coma, necessitating intubation, sedation, and transfer to the intensive care unit (ICU). A subsequent brain CT scan showed diffuse brain oedema (see Fig. 1). Other conditions that can lead to a coma, such as hypoglycaemia, hyponatraemia, seizures, hypercapnia, or hypoxia, were ruled out.

An intracranial probe for multimodal monitoring was inserted and intracranial pressure (ICP) was measured at -5 mm Hg in the drainage position with the upper body elevated to 30°. Brain oximetry and pressure reactivity index were monitored. The position of the probe was checked using a CT brain scan. The patient remained sedated and ventilated for 48 hours, sustaining stable low ICP levels between -5- and 2- mm Hg. Upon cessation of sedation, the patient showed a gradual improvement

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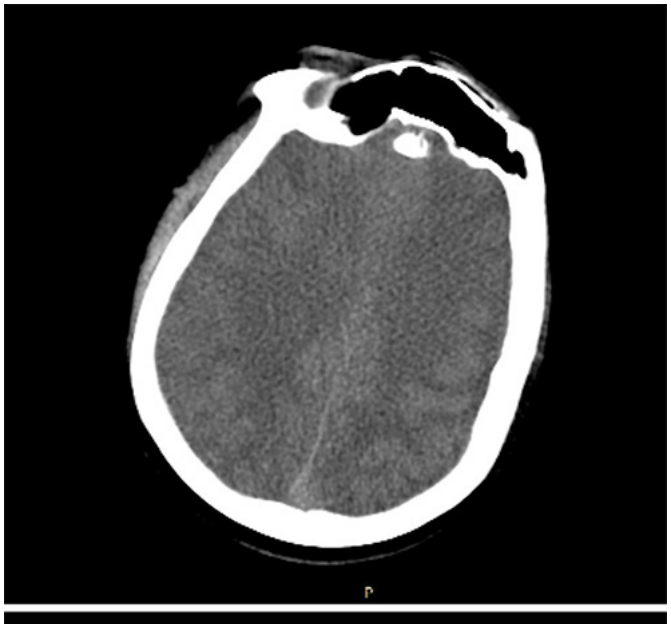
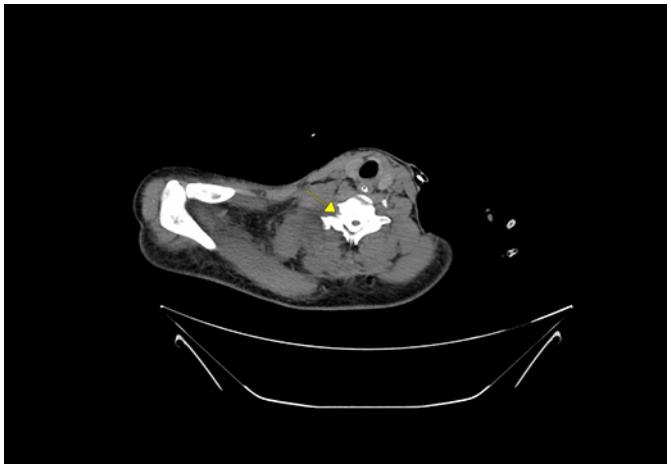
Fig. 1. *CT brain scan obtained after admission to ICU*



in consciousness, which was consistent with the changes in ICP levels. Higher ICP levels were associated with a better state of consciousness.

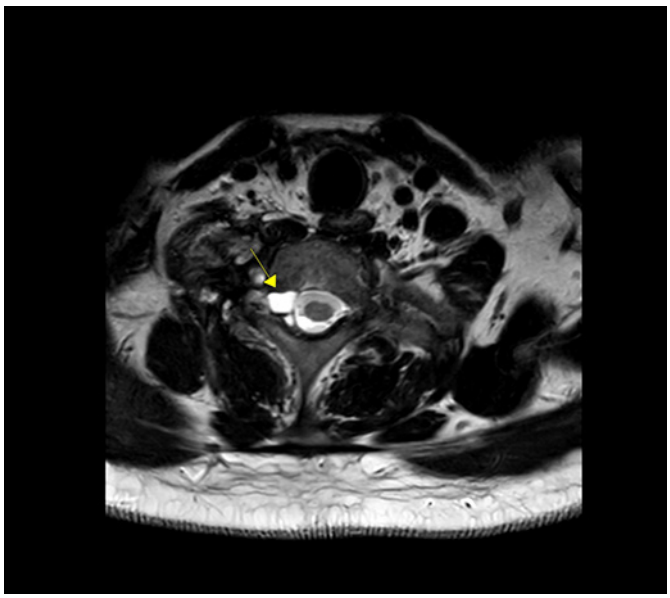
Due to the observed correlation between improved consciousness and elevated ICP, concerns arose regarding CSF leakage. However, a magnetic resonance (MRI) scan was performed, revealing an unexpected C5 and C6 root avulsion without any signs of vertebrae trauma. Because of this finding, CT perimyelography was performed revealing CSF leakage through the C5 and C6 root avulsion as depicted in Fig. 2.

Fig. 2. *CT perimyelography. The arrow indicates C5 root avulsion with leakage of contrast fluid showing probable location of cerebrospinal fluid leakage*



After the finding, the patient was positioned in the dorsal recumbent position. The ICP stabilized spontaneously at around 3 mm Hg on the 4th day following admission. The patient regained full consciousness and was extubated on the 5th day and discharged from the ICU on the 6th day. After discharge from the ICU, there were no signs of continuous CSF leakage, including follow-up CT perimyeolography. A follow-up MRI scan was performed showing signs of pseudomeningocele formation (see Fig. 3). The patient remained in hospital till the 24th day. From the discharge from the ICU till the discharge from hospital, the management was focused on rehabilitation and analgesia.

Fig.sub 3. *Follow-up MRI. The arrow indicates the formation of a pseudomeningocele*



The patient underwent brachial plexus reconstruction three months later. During the surgery, C5, C6, and C7 roots were reconstructed with the use of grafts from the posterior division of the upper trunk and suprascapular nerve. Presently, the patient shows paresis of the right arm classified as score 2 on the Neurological Impairment Scale (NIS).

Discussion

Intracranial hypotension is a rare condition that is typically characterized by postural headaches, rarely by coma. Severe cases can be life-threatening. Major severe complications are cerebellar haemorrhage, posterior circulation infarction, brain herniation, and cerebral venous sinus thrombosis [5–7]. Normally, intracranial hypotension causes recurring postural headaches, but coma can rarely be the sole sign, as it was in the presented case [1–2]. IH is rarely associated with trauma. More often, it occurs in neurointensive care units, mostly in association with neurosurgery or ventricular/lumbar drainage. In well-documented cases by Sarrafzadeh, IH was a result of a spine injury with a CSF leak [4]. Interestingly, in our case, there was no spine injury. We only diagnosed avulsions of two roots resulting in CSF leakage. Notably, there was no injury to surrounding vessels.

In most trauma patients, the whole-body CT scan is performed. Nonetheless, the CT scan is not sufficiently sensitive to diagnose IH or CSF leakage. CT may show CSF collections, which can make the diagnosis easier [8]. This was demonstrated by Sarrafzadeh in both documented cases where CSF collection was a key finding. In our case, however, the CSF leak did not form a collection. To prompt further imaging studies, there should be a firm clinical suspicion of IH. In our case, the suspicion was based on a very low and negative ICP and an improvement in the state of consciousness with higher ICP levels. Another imaging method to consider is cranial MRI which can provide the diagnosis in 80% of cases [8, 9]. We performed an MRI scan with the finding of avulsions without clear signs of CSF leakage. Therefore,

we performed CT perimyelography which showed subtle CSF leakage at the levels of avulsions.

Treatment of intracranial hypotension ranges from conservative management, such as bed rest, overhydration, mild hypertension, and caffeine, to invasive procedures. Most patients are successfully treated conservatively. Among invasive procedures, a blood patch is one of the most common interventions [3]. Urgent management may include positioning the patient in the Trendelenburg position [4]. In our case, the CSF leakage ceased after positioning.

In conclusion, our case demonstrates the importance of being aware of the trauma and IH association, even in the absence of head or spinal trauma. Moreover, several lessons should be learned from this case. First, diagnosing intracranial hypotension is challenging due to the absence of pathognomonic signs on standard CT scans; therefore, additional tests such as perimyelography need to be employed. Second, a negative or very low intracranial pressure should always lead to considering the presence of intracranial hypotension due to cerebrospinal fluid leakage as a possible cause of coma. And third, it is crucial to move the patient with known or suspected CSF leakage from the standard semirecumbent position to the supine position or, in urgent situations, to the Trendelenburg position.

Conclusion

Intracranial hypotension is a relatively rare, but clinically significant finding that may affect the final clinical outcome. We should always consider its presence in patients where there is no other, clinically more relevant explanation for the deterioration of consciousness.

Written consent for publication was obtained from the patient

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REFERENCES

1. Albes G, Weng H, Horvath D, Musahl C, Bäzner H, Henkes H. Detection and treatment of spinal CSF leaks in idiopathic intracranial hypotension. Neuroradiology. 2012 Dec 1;54(12):1367-73. doi: 10.1007/s00234-012-1055-3.

2. Berroir S, Loisel B, Ducros A, Boukobza M, Tzourio C, Valade D, et al. Early epidural blood patch in spontaneous intracranial hypotension. Neurology [Internet]. 2004 Nov 23;63(10):1950-1. doi.org/10.1212/01.WNL.0000144339.34733.E9.

3. Ferrante E, Arpino I, Citterio A, Wetzl R, Savino A. Epidural blood patch in Trendelenburg position pre-medicated with acetazolamide to treat spontaneous intracranial hypotension. Eur J Neurol. 2010 May;17(5):715-9. doi: 10.1111/j.1468-1331.2009.02913.x.

4. Sarrafzadeh AS, Hopf SA, Gautschi OP, Narata AP, Schaller K. Intracranial hypotension after trauma. Springerplus. 2014;3(1):1-7. doi: 10.1186/2193-1801-3-153.

5. Chi NF, Wang SJ, Lirng JF, Fuh JL. Transtentorial herniation with cerebral infarction and duret haemorrhage in a patient with spontaneous intracranial hypotension. Cephalalgia. 2007 Mar;27(3):279-82. doi: 10.1111/j.1468-2982.2007.01259.x.

6. Zhang D, Wang J, Zhang Q, He F, Hu X. Cerebral Venous Thrombosis in Spontaneous Intracranial Hypotension: A Report on 4 Cases and a Review of the Literature. Headache. 2018 Sep;58(8):1244-1255. doi.org/10.1111/head.13413.

7. Pleasure SJ, Abosch A, Friedman J, Ko NU, Barbaro N, Dillon W, Fishman RA, Poncelet AN. Spontaneous intracranial hypotension resulting in stupor caused by diencephalic compression. Neurology. 1998 Jun;50(6):1854-7. doi: 10.1212/wnl.50. 6. 1854.

8. Chan SM, Chodakiewitz YG, Maya MM, Schievink WI, Moser FG. Intracranial Hypotension and Cerebrospinal Fluid Leak. Neuroimaging Clin N Am. 2019 May 1;29(2):213-26. doi: 10.1016/j.nic.2019. 01. 002.

9. Chazen JL, Talbott JF, Lantos JE, Dillon WP. MR myelography for identification of spinal CSF leak in spontaneous intracranial hypotension. American Journal of Neuroradiology. 2014 Oct 1;35(10):2007-12. doi: 10.3174/ajnr.A3975.