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Posttraumatic Cerebrospinal Fluid Rhinorrhea Accompanied by Pneumocephalus – Case Report

Pourazowy płynotok nosowy z odmą śródczaszkową – opis przypadku

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Abstract

Cerebrospinal fluid rhinorrhea accompanies about 2% of blunt head traumas and in half of these cases it results from fracture of the anterior cranial fossa. This life-threatening condition may lead to meningitis, often with lethal outcome. Another complication of head injury is pneumatocele. It is present in ca. 0.5–1% of head injuries, but it occurs in up to 30% of patients suffering from rhinorrhea. The main difficulty in diagnosing both pathologies is due to the delayed onset of their symptoms, as was the case of the described patient. The patient did not consent to surgical management, which is the treatment of choice for the considered conditions. The conservative treatment which was introduced resulted in the resolution of both pathologies (*Adv Clin Exp Med* 2007, 16, 6, 819–823).

Key words: cerebrospinal rhinorrhea, intracranial pneumocephalus, cranial injury, conservative treatment.

Streszczenie

Płynotok towarzyszy około 2% zamkniętych urazów głowy, a u połowy chorych jest związany ze złamaniem przedniego dołu czaszki. Zagrożenie życia chorego związane z powstaniem płynotoku wynika z możliwości rozwinienia się zapalenia opon mózgowo-rdzeniowych o bardzo ciężkim przebiegu. Innym typem patologii urazów głowy jest odma śródczaszkowa. Towarzyszy ona około 0,5–1% urazów głowy, ale aż w 30% współistnieje z płynotokiem. Trudności związane z rozpoznaniem obu chorób wynikają przede wszystkim z późniejszego ich wystąpienia, tak jak to miało miejsce u leczonego przez autorów chorego. Chory nie wyraził zgody na leczenie operacyjne, które jest bezwzględnie wskazane w tego typu przypadkach. Prowadzone z konieczności leczenie zachowawcze doprowadziło do ustąpienia obu patologii (*Adv Clin Exp Med* 2007, 16, 6, 819–823).

Słowa kluczowe: płynotok, odma śródczaszkowa, urazy głowy, leczenie zachowawcze.

Cerebrospinal fluid leakage through the nose, known as cerebrospinal fluid rhinorrhea (CSFR), is a pathology caused by the formation of a fistula between the cranium and the roof of the nasal cavity, ethmoid air cells, frontal or sphenoid sinus, and tympanic membrane [1]. CSFR may be caused by a trauma, a neoplasm that destroys the bone structure, osteitis, hydrocephalus, and congenital bone structure abnormalities; it may also have no apparent cause [2, 3] (Fig. 1). The fistula forms a potential gate of infection from the nasal cavity and paranasal sinuses directly into the cranium, which may lead to cerebrospinal meningitis and encephalitis.

In 1700, the Dutch surgeon Bidloo was the first to report a case of posttraumatic rhinorrhea, which he described as “a fountain-like leakage from the nose” [4]. Rhinorrhea accompanies 2–3% of head injuries; in 50% of them it is due to anterior cranial fossa fracture. The most common causes of CSFR-related injuries are vehicle accidents and physical assault and battery [4, 5]. CSFR may present as a minor, clear leakage from the nose, resembling allergic rhinitis. It is often a great challenge to distinguish between these two conditions; the relevance of differential diagnosis is thus of special importance in the emergency ward and determines the treatment [6, 7].

Pneumocephalus is another life-threatening condition that accompanies 0.5–1% of head injuries; however, it can be present in up to 30% of patients with posttraumatic CSF rhinorrhea [2, 8]. Beside direct trauma, the causes of pneumocephalus include inflammation of the facial bones (especially the middle ear) and barotraumas (for instance those related to diving) [9, 10]. The most dangerous is tension pneumocephalus, produced by the formation of a valve at the injury site, because this leads to an increase in intracranial pressure. Pneumocephalus is particularly frequent when the air pressure in the nasal cavity rises rapidly, as occurs during coughing or sneezing. Pneumocephalus comprises a greater risk to the patient because communication between the cranium and the environment is characterized by the intracranial direction, which obviously increases the risk of meningitis [1].

The relative rarity of the aforementioned pathologies related to head injuries and the serious risk associated with them requires emergency medicine specialists to be prepared for handling both CSF rhinorrhea and pneumocephalus. The aim of this report is to familiarize emergency medicine professionals with these conditions.

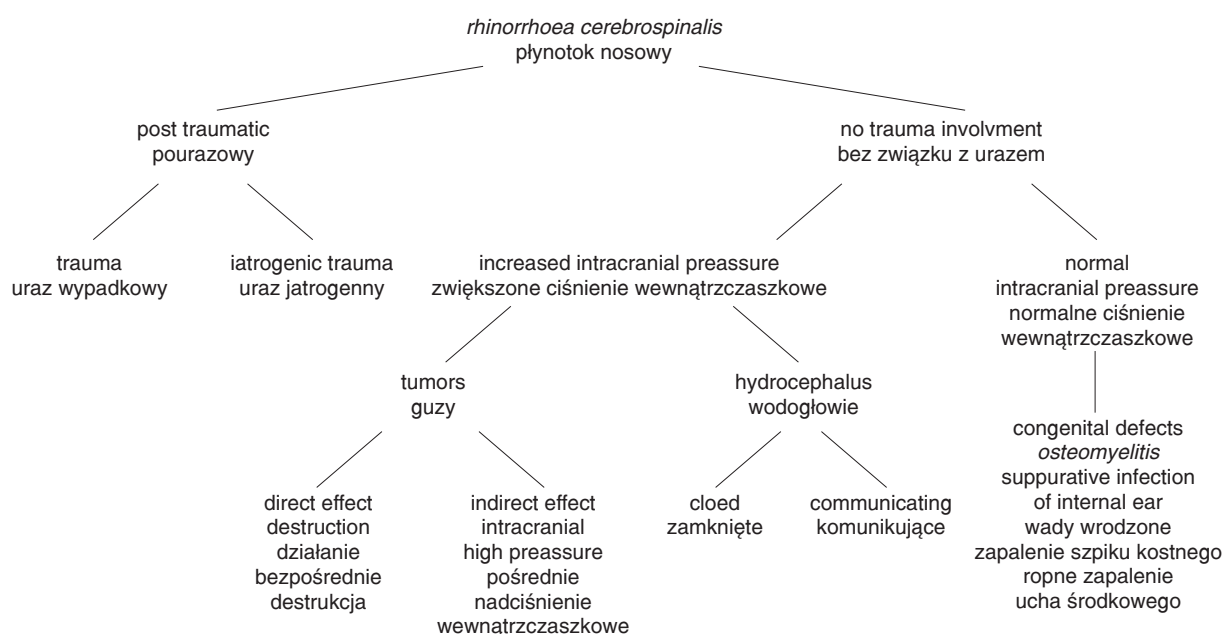
Case Description

A 40-year-old male intoxicated with ethanol, was admitted to the emergency room after experiencing a transportation accident (Glasgow Coma

Scale 13, BP 130/70 mmHg, HR 108/min, Hb saturation 92%, blood alcoholic content 3.62‰). A preliminary physical examination revealed ecchymosis on the chest (CXR: fracture of the posterior part of the 7th left rib and frontal part of the 2nd left rib), a minor wound of the left region of the forehead, excoriation of the nose, and minor bleeding from both nasal meatus. No neurological defects of the central nervous system were observed. Similarly, abdominal ultrasonography did not reveal any post-traumatic injuries of the internal organs. The head X-ray made on admission of the patient did not present any apparent pathology.

In the first days of hospitalization, the patient's condition did not differ significantly from the norm. On the second day of hospitalization a neurologist examined the patient and described his state in the following way: "correct praxis; comprehensible and logical speech; absent meningeal reflexes; equal, regular, reactive pupils; extensor plantar response present bilaterally; no focal signs of CNS deterioration" (P. Szada, MD).

Based on the results of this examination, the intensive vigilance was interrupted and the patient was being prepared to be discharged from the hospital. However, because of the lack of any means of transport, the patient asked to be discharged the following day (i.e. on day 4). On that day, the patient's state worsened. He reported symptoms of a common cold, suggested by shivers and abundant water-clear discharge from the nose; the neurological state was correct. An X-ray of the skull, performed again in the typical projections,



Ryc. 1. Przyczyny płynotoku nosowego

Fig. 1. Causes of cerebrospinal fluid rhinorrhea



Fig. 2. Skull X-ray made on admission – no apparent pathology

Ryc 2. RTG czaszki w chwili przyjęcia do oddziału – bez widocznej patologii

revealed air occupying the cerebral ventricles; the paranasal sinuses were correctly filled with air, with there were no pathologies (Fig. 3).

Since CSF rhinorrhea accompanied by pneumocephalus was suspected, antibiotic treatment was instituted and the nasal discharge was examined, and because of its properties (yellowish, turbid, protein concentration 1.1 g/100 ml, glucose 63 mg/100 ml, ALP activity 34U/l) it was classified as transudate. Urgent CT of the head confirmed air accumulation in the anterior parts of both lateral ventricles and a few minor accumulations in the paracerebral and subarachnoid spaces. The CT image also revealed “a hypotensive zone at the base of the right frontal lobe – a probable result of the trauma; signs of cortical and subcortical atrophy with dilatation of the paracerebral CSF space in the region of the left frontal lobe; a basilar skull fracture in the sphenoid plane and in the roof of the sphenoid sinus; abundant liquid occupying the sphenoid sinus, most probably blood. No other pathologies were visible.” (B. Hendrich, MD).

Based on the performed examinations, a complex cranio-cerebral injury was diagnosed. The patient was therefore transferred to a neurosurgical ward, where CSF rhinorrhea intensification was observed. The patient complained of nausea, headache, and vertigo since admission to the hospital. On inclination of the patient's head, the CSFR intensified. CSF diversion was performed twice with subsequent examination of the liquid: color clear yellow, transparency slightly turbid, benzidine reaction positive (++), RBC 10,000/ μ l, pleocytosis 60/3, lymphocytes 68%, and polymorphonuclear leukocytes 32%. After centrifugation the color was clear yellow, transparency totally transparent, benzidine probe negative, Pandy's reaction ambiguous



Fig. 3. Skull X-ray on the 4th day of hospitalization – note the pneumocephalus

Ryc 3. RTG czaszki wykonany w 4. dobie hospitalizacji, widoczna obecność powietrza

(+, –), Nonne-Apelt reaction positive (+), and protein concentration 41.5 mg/100 ml.

For surgical treatment, the patient was offered a duraplasty and closing of the CSF fistula. However, he did not consent to this therapy. The conservative treatment was thus continued, i.e. obligatory semisupine position and a 10-day-long antibiotic treatment (Ofraamax, 2 g/day). In this way, the CSF leak resolved successfully. During tilt trials, the patient complained of pains and vertigo; however, these symptoms resolved spontaneously. Moreover, the onset of an insignificant retrograde amnesia of the pre-trauma period was noted. The patient was dismissed from the neurosurgical ward on day 21 of hospitalization. Later he appeared regularly to the outpatient clinic. The follow-ups revealed no neurological disorders; the cough trial and the Valsalva maneuver were negative. An X-ray of the skull done two weeks after leaving the hospital showed no air presence in the cranial cavities (Fig. 4). The last follow-up, performed 11 months after the trauma, showed no deviations from the norm, and the patient did not report any episodes of fever, headaches, sinusitis, or rhinitis.

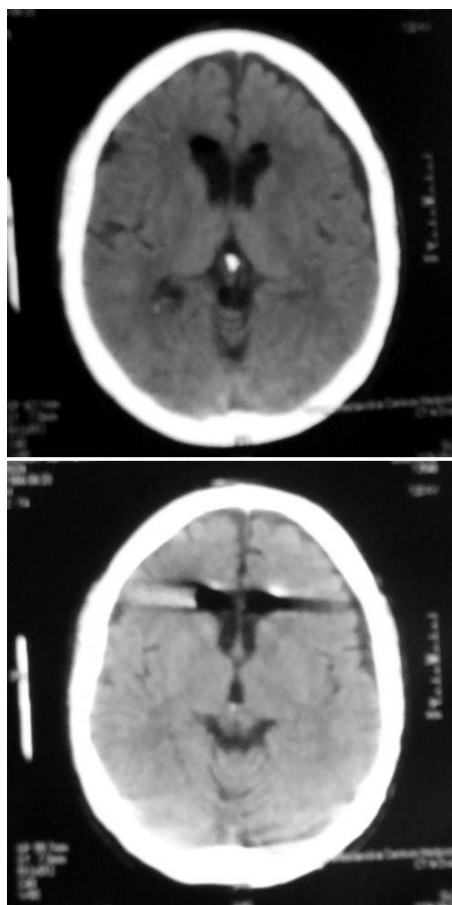


Fig. 4. CT scan depicts air presence in the cerebral lateral ventricles

Ryc. 4. Badanie TK – obecność powietrza w komorach bocznych mózgu

Discussion

A fistula through which CSF leaks forms most commonly where the bones composing the base of the skull are relatively thin. That is why CSFR fistulas are mainly located in the lamina ethmoidea or in the roof of the anterior/posterior part of the labyrinth ethmoidalis (ca. 40%). The leak may also occur from the posterior wall of the frontal sinus (15%) or from the roof of the sphenoid sinus (15%). Occasionally, cerebrospinal fluid may leak into the nasal cavity from the middle ear through the auditory tube [2–4]. A common cause of these leaks is a fracture of the roof of the tympanic cavity, which constitutes a part of the base of the skull. Leakage of CSF into the throat represents the main sign of this type of CSFR. The rhinorrhea may start soon after the trauma or a few days later when the tissular edema resolves and the coagula are resorbed, thus opening new communication between the *fossa cranii media* and the paranasal sinuses [1, 4, 7].

The differential diagnosis of CSF rhinorrhea often presents a challenging problem. Examining the glucose level in the leaking fluid is very helpful,



Fig. 5. Follow-up X-ray made two weeks after discharge from the hospital shows no pathologies

Ryc. 5. Kontrolne badanie RTG 2 tygodnie po opuszczeniu oddziału – pełna remisja zmian patologicznych

since a glucose concentration > 30 mg/100 ml confirms the CSFR diagnosis. Of great value is also an immunological assay that detects β -2 transferritin because this protein is present only in the CSF and the vitreous, so blood presence in the sample does not influence the result [1]. Nevertheless, this test is hardly available in Poland. If a fluid specimen cannot be obtained or the very presence of a fistula is doubtful, scintigraphy might be applied. In this way, after intrathecal administration of a radioactive tracer (for instance ^{99m}Tc), radioactivity of the gastric content may be shown if the fluid leaks onto the posterior wall of the throat [1, 5, 7].

Air presence in the skull is perceived as “flows inside the head”, and in senile patients it may cause awareness disorders [2, 11]. The air usually accumulates in the highest level of the subarachnoid space and/or in the cerebral ventricles, as occurred in our patient. Highly dangerous is the valvular mechanism of pneumocephalus; in this case, air accumulates in the skull with every inspiration. This quickly leads to an increase in intracranial pressure and requires an urgent neurosurgical procedure, such as a trephinopuncture [2, 8]. Most commonly, pneumocephalus forms during the six hours after an acute head trauma [1]. Nonetheless, cases are known in which pneumocephalus occurred weeks after the trauma [11].

There are various techniques of managing CSFR [3, 4, 7]. However, it seems that CSFR

should be treated surgically because the scar has an impaired resistance, which may result in recurrence of the CSF leaks even years after the trauma [4, 5, 12–14]. CSFR accompanied by pneumocephalus is a stronger indication for surgical treatment than CSFR alone. In such a case, the operation should take place ca. two weeks after the trauma [2, 8]. Szurmacz suggests that surgical treatment allows for closing the fistula permanently in 95% of patients, while 25% of patients treated conservatively died three years after the trauma due to pyogenic cerebrospinal meningitis [4]. Unfortunately, it was impossible to operate our patient (suspected of alcoholism) since he refused to consent to the operation although we provided him detailed information on possible complications.

The clinical picture of our patient is relatively uncommon. Its following features need to be stressed: no apparent lesions in the preliminary X-ray, onset of CSFR and pneumocephalus a few days after the trauma with no accompanying neurological disorders, and resolution of CSFR and pneumocephalus in the third week of conservative treatment.

A one-year-long observation of the patient is obviously not enough for estimating the risk of CSFR recurrence, but that is not the aim of this report. Awareness of the diagnostic difficulties associated with CSFR and pneumocephalus as well as their insidious course is of practical importance for traumatologists. With the above data in mind, it is no exaggeration to state that even the apparently most trivial head injuries require scrupulous observation.

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