Pneumacephalus after Influenza virus infection and its implication to modern anterior skull base surgery

Commentary on

Widespread subarachnoidal pneumocephalus development as a complication of influenza: a case report

Dilcan Kotan

Arch Med Sci 2008; 4, 4: 471–473

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Submitted: 15 March 2008
Accepted: 19 March 2008

Arch Med Sci 2008; 4, 4: 474–475

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In the present issue, Kotan [1] presents an excellent and interesting case report about pneumacephalus after influenza virus infection, a topic that may be underestimated in its incidence. Delayed pneumocephalus represents a rare but well-reported complication of cerebrospinal fluid (CSF) diversion diseases that may be also the origin of the disease in the presented case. The exact pathophysiology of the development of pneumocephalus after influenza virus infection is not yet known, but may be related to the disruption of the olfactory mucosa [2]. Mucosal destructions of the olfactory fila can therefore permit to transport the air into brain [2].

There is an ongoing discussion about the best treatment modality of anterior skull base fistulas. It is generally believed that such persistence of pneumacephalus is – at least partly – due to depression of intra-cranial pressure [3]. As a further consequence of this, the risk of intracranial infection is increased in association with a hypoliquorrhea [3]. In the special case of underlying viral encephalitis, we know that PCR virus identification in CSF for secondary neurological syndromes, as e.g. pneumocephalus, is difficult [2] and that lumbar punction remains often false negative sterile [2]. The main problem of PCR interpretation may be related to the blood-brain-barrier (BBB) that represents cellular interface between the circulating blood and neural environment, and is created by apposed endothelial cells and their intercellular tight junctions. Many aspects of how the BBB functions at the molecular level remain unresolved that hinders exact interpretation of PCR in cerebrospinal fluid [4]. However, this uncertainty of diagnosis may be one reason that explains the lack of general accepted treatment recommendations.

Generally, every fistula of the paranasal sinuses is to be closed watertight and secure surgically because of its potential risk of ascending bacterial meningitis, even years or decades after the initial event [5]. Rather, Kotan suggests that as "CSF paranasal fistulas may be healed spontaneously, endoscopic paranasal exploratory surgery does not require".

However, this statement seems problematic to us. First, although a scar after spontaneous healing might suffice in the short term period, it should be remembered that scars are often an inadequate barrier against infection. The patient will remain at cumulative risk of developing potentially fatal intracranial complications after years or even decades; a circumstance that is reported to lead to ascending bacterial meningitis in 2-3% [5] and is therefore more prone for meningitis than normal tissue. Second, following virus encephalitis, by for example influenca virus, a secondary ascending bacterial meningoencephalitis or even abscess may be potentially fatal. Third, the known incidence of late-stage ascending bacterial meningitis, even after years or decades, is too high to let it primarily untreated. Is it for these points, as conservative treatment of fistula of the paranasal sinuses, with or without cerebrospinal leak, is currently not recommended [5, 6].

In addition, the prophylactic empiric antibiotic treatment of a sterile lumbar punction remains under question. The general believe is "to treat only where signs of infection are". This is contradictory to any prophylactic antibiotic treatment and is underlined by clinical examinations, in which was a significantly greater incidence of meningitis in the subgroup which received prophylactic antibiotics [7]; this is especially the case, if the antibiotic's permeability of the BBB is not known. On the other hand, we know that lumbar punctions after viral infection are difficult to be interpreted in case of bacterial superinfection and that we have a certain number of false negative punctions. However, we would therefore not recommend any prophylactic antibiotic treatment in anterior skull base fistula, including the special case of pneumacephalus.

Even so, the indication for surgical repair may not be a matter of debate, but the surgical approach is it. It is generally accepted that the intradural repair has a too high failure rate to be recommended so that it is reserved only for special cases. In the decade of key-hole surgery, only extradural approaches are suitable. The endoscopic endonasal approach has become the favourite route for treating cerebrospinal fluid leaks of the anterior skull base [8]. Better results have been obtained with the improvement of rigid endoscopes and intrathecal sodium fluorescein [8]. Therefore, it may be an indication for paranasal endoscopic surgery, but that it has – besides the CSF fistula with rhinorrhoe – an unexpectatory high failure rate as the surgical field is limited [9, 10]. One should always be aware of the fact that a CSF fistula or an inadequate thin dural scar may not be immediately obvious to a physician and may require sophisticated diagnostic testing to locate; especially, some patients have more than one site of damage [11]. For this reason, the extradural subcranial approach to the repair of the anterior skull base fistula has been propagated by Joram Raveh: that approach takes advantage of the specific features of injuries in this region and allows direct access to the central anterior cranial base. We therefore would highly recommend this approach for the surgical repair of anterior skull base fistula leading to pneumacephalus.

The interesting case report by Kotan therefore opens different windows: first, the best treatment of anterior skull base fistula, a question about conservative treatment or surgical repair that is still under debate. Second, the question of prophylactic empiric antibiotic treatment of anterior skull base fistula. Last, but not least the debate about the best surgical approach to the anterior skull base.

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