

## Background

This work aims to determine how antibiotic therapy influences MR spectroscopic findings in patients undergoing treatment for pyogenic brain abscess and to comprehensively evaluate this naturally dreaded complication from a purely medical perspective by using an evidence-based approach and comparison with available literature which mostly comprises case reports.

## Methods

This prospective, single center study included all patients who received treatment for brain abscesses at the Neurosurgery Department of University Hospital Ostrava between 2012-2017. Pre-operative MR imaging was carried out on all patients including diffusion-weighted imaging and in vivo single-voxel proton spectroscopy with intermediate echo time. The following factors were evaluated: duration of antibiotic therapy, characteristics of MR imaging and spectra findings and culture results. Particular consideration was given to the effect of pyocephalus on morbidity and mortality rates and C-reactive protein levels, as well as the identification of risk factors and its possible therapeutic influence. Patients were followed up for 6 months.

## Results

MR spectroscopy findings characteristic of brain abscesses, i.e. the resonances of at least one of the metabolites concerned (amino acids, acetate, alanine and succinate), were observed in 20 patients who had undergone antibiotic therapy for less than 72 hours beforehand (median 7 hours; IQR 30 hours). The 19 patients who underwent antibiotic therapy for longer than this (the median time was 336 hours with an IQR of 284 hours) showed no abscess-specific metabolites, only nonspecific lactate and/or lipid resonance ( $p < 0.0005$ ). These results were further compared with culture findings of pus samples taken intra-operatively: a significantly higher rate of positive culture (78,2 %) was determined in cases where antibiotics were administered less than 72 hours before MRS ( $p < 0.0005$ ). In the cohort as a whole, mortality and morbidity rates were 23.3 % and 48.8 % respectively, while the incidence of mortality and morbidity among patients with pyocephalus (incidence 11,6 %) was 40 % and 66.6 % respectively. The presence of pyocephalus is not a significant predictor of either morbidity ( $p = 0.575$ ) or mortality ( $p = 0.664$ ). Immunocompromised patients had nonsignificant mortality ( $p = 1,000$ ) and morbidity ( $p = 0,240$ ) rates. In patients with pyocephalus, we determined elevated CRP levels on the day of surgery ( $p = 0.038$ ). The occurrence of epileptic seizures in the acute phase of the disease is associated with a poor outcome ( $p = 0.039$ ).

## Conclusions

Prolonged antibiotic therapy can influence MRS findings in pyogenic brain abscesses – a fact which is certainly necessary to take into account in its differential diagnosis. The disappearance of the characteristic metabolites can be indirectly interpreted as an indicator of successful antibiotic therapy in cases where surgical intervention is not possible. Further study in this field is required to confirm the results of this study. Pyocephalus will continue to be a serious complication in the treatment of brain abscess, and we could not determine its utility as a prognostic factor. Patients with this complication have elevated CRP levels on the day of operation.