Machine learning to combat hospital-acquired infections

March 13 2018

A group of scientists and doctors led by Skoltech Professor Vladimir Zelman has studied hospital-acquired meningitis risk factors using machine learning methods. Their research findings were published in the *Journal of Critical Care*.

Hospital-acquired meningitis is a grave complication that develops as a result of neurosurgical interventions and brain injuries, and often leads to disability and death. The disease is extremely difficult to treat, since in the majority of cases, it is caused by bacteria resistant to multiple antibiotics. Studying the main risk factors and finding ways of preventing infection are the main tools for reducing the incidence of hospital-acquired meningitis.

From 2010 to 2017, scientists from Skoltech and the University of Southern California jointly with doctors from the N.N. Burdenko Center for Neurosurgery studied a group of 2,286 patients undergoing intensive treatment for nervous system diseases and injuries. Of these, 216 were diagnosed with hospital-acquired meningitis. To identify meningitis risk factors, the researchers used several mathematical approaches, including classical statistical analysis and machine learning. They discovered four key risk factors: craniotomy, infection in the area operated on, leakage of the fluid circulating in the brain, and drainage of the brain ventricles. Machine learning provided convincing testimony to the strong impact of these four factors on the disease pathway.

This is the first study to unveil the truth about hospital-acquired

meningitis morbidity in Russia and to demonstrate the efficiency of machine learning in the prediction of risk factors. "Our project addresses a unique and vast collection of clinical observations. This is an absolutely unprecedented experience for Russia. The novelty of the data collection and analysis approach provides good grounds for arguing that this study is a big step forward in the search for effective methods of fighting hospital-acquired meningitis. The main challenge we are faced with is preventing bacteria from spreading over the hospital and getting into a patient's nervous system. Of course, there is still a lot of work ahead but I believe that this project is an excellent example of successful international cooperation that should be continued," says Project Lead and Skoltech Professor Vladimir Zelman.

More information: Savin, Ivan, Ksenia Ershova, Nataliya Kurdyumova, Olga Ershova, Oleg Khomenko, Gleb Danilov, Michael Shifrin, and Vladimir Zelman. "Healthcare-Associated Ventriculitis and Meningitis in a Neuro-ICU: Incidence and Risk Factors Selected by Machine Learning Approach." *Journal of Critical Care* 45 (June 1, 2018): 95–104. doi.org/10.1016/j.jcrc.2018.01.022