



Early diagnosis of Neuroblastoma by liquid Chromatography combined with tandem mass spectrometry (LC-MS/MS) suitable for clinical use

Chromatography

In chemistry, chromatography (Greek for writing colors) is the name given to a process that allows a mixture of substances to be separated by distributing its individual components differently between a stationary and a mobile phase.

LC-MS/MS

A mass spectrometer can be used to qualitatively and quantitatively measure compounds that are in the form of ions (charged molecules). The other ions contained in the matrix are deflected due to their unstable trajectory and lose their charge.

Consideration of the factor: age of the children

The researchers first determined the normal ranges for VMA and HVA levels of children in different age groups - both for 24-hour urine and for random samples. In doing so, it was found that the levels of these biomarkers changed with age and varied by sample type. This clearly demonstrated the importance of including age-adjusted reference intervals for children for correct interpretation of test results.

„[...]The researchers achieved a diagnostic sensitivity of 85 percent and a specificity of 95.7 percent by measuring levels of both biomarkers in 24-hour urine samples using age-adjusted reference intervals[...]“ (Dr. Alison Halliday, Source: <https://de.elgalabwater.com/blog/neuer-test-zur-diagnose-einer-aggressiven-krebserkrankung-bei-kindern>).

However, only a few of the urine samples with elevated catecholamine levels were available for the project. Therefore, larger data sets are required in the next necessary step to finally evaluate the performance and use of this much simpler diagnostic method.

Conclusion

In conclusion, it can be stated that in this study the scientists certainly developed and validated a simple, rapid and robust LC-MS / MS method for the simultaneous measurement of VMA and HVA in urine. This also laid the foundation for application in clinical laboratories for the diagnosis of neuroblastoma. Another important factor is the reliable access to high quality ultrapure water.

Early diagnosis can improve the survival of a child with neuroblastoma. A new study validates a simpler and faster liquid chromatography combined with tandem mass spectrometry (LC-MS/MS) suitable for clinical use.

„Neuroblastoma is an aggressive cancer of the nervous system that affects approximately 312 children in Poland each year - mostly infants after reaching the age of 5. The disease is one of the most common malignant cancers in children in Poland and generally accounts for about 8-10% of all childhood cancers“ (Agata Pitrus, 2022, quoted after *prof. nadzw. dr hab. n. med. Anna Raciborska*, Source: <https://imid.med.pl/pl/neuroblastom>). Timely and effective diagnosis is the key to successful treatment - the earlier the cancer is diagnosed in a child, the greater the chances of survival.

Clinical diagnosis of neuroblastoma is regularly made by abdominal ultrasound - but a urine test could always be a faster and easier way. Since the disease often has its onset and the adrenal glands, this can consequently lead to an increase in catecholamine levels in the body. Detection of elevated levels of the metabolic byproducts of these hormones - homovanillic acid (HVA) and vanillylmandelic acid (VMA) - can therefore effectively support a clinical diagnosis of the disease.

Despite all the positive aspects, it is important to note that current analytical methods for detecting and measuring these chemical compounds in urine samples have limitations - and therefore radical new techniques and inventions are urgently needed.

A new clinical diagnostic test

Researchers at Huazhong University in China are working to develop and validate a simple and rapid LC-MS/MS method for the side-by-side measurement of VMA and HA in urine.

The researchers have already demonstrated that the new method is highly sensitive, with a lower limit of quantification and a limit of detection of „[...] 0.50 and 0.25 µmol / L for both of the latter metabolites. The results were possible using ultrapure water from an ELGA laboratory water system. The ultrapure water was used for the preparation of stock solutions of VMA and HVA as well as for the internal standards[...]“ (Dr. Alison Halliday, Source: <https://de.elgalabwater.com/blog/neuer-test-zur-diagnose-einer-aggressiven-krebserkrankung-bei-kindern>).

The team evaluated diagnostic performance by measuring VMA and HVA levels in numerous urine samples. Of these, a full 19 children were diagnosed with neuroblastoma. The urine samples were collected in two different ways - either over a 24-hour period or randomly.

Sources :

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