

Urine holds clue to deadly cancers

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The conventional protocol of testing blood samples to diagnose diseases may change soon. A new study shows that human urine proteins bear telltale signs of diseases such as cancers and neurodegenerative disorders¹. Urine can serve as an excellent bodily fluid for identification of novel biomarkers for diseases at an early stage, the researchers contend.

"Collection of urine is a non-invasive procedure and composition of urine is less complex as compared to serum or plasma, making it an attractive biological sample for clinical diagnosis," says Akhilesh Pandey who led an international joint research team comprising researchers from USA, India and Germany.

Kidneys filter out unwanted chemicals from blood and excrete them with urine. The excreted urine contains water, glucose, salt and other metabolites in addition to small amounts of proteins. Thus urine can provide information on physiological processes that take place in various organs and kidneys.

Previous studies have identified 120-150 proteins in urine using two-dimensional gel electrophoresis and mass spectrometry. One of the studies using sophisticated mass spectrometry identified 1000 proteins in urine. However, none of these studies gave comprehensive view of urine proteins. In addition, studies have hinted that urine could harbor potential biomarkers for systemic illnesses such as renal disorders including prostate and colon cancers.

To yield a comprehensive map of urine proteins and to pinpoint the link between urine proteins and diseases, the researchers analysed urine samples collected from multiple healthy individuals using high-resolution Fourier transform mass spectrometry. They detected 1823 proteins of which 671 had not been previously reported in urine.

More than 90% of these proteins were identified for the first time. About 23% of the proteins identified in urine were common to proteins reported in plasma. The study detected some novel voltage gated potassium ion channel proteins (KCNE4, KCTND12, and KCNH5). These proteins form the ion channels on cell membranes facilitating exchange of potassium ions. Of these proteins — KCNE4 — has been linked to childhood acute lymphoblastic leukemia. Aberration in KCNH5 leads to lung cancer.

The large majority of the identified proteins are involved in the crosstalk of cells, cell growth or metabolism. Some of the proteins have roles in cellular transport and immune responses. The study also identified a group of fatty acid binding proteins (FABPs). Of them, FABP1 is a biomarker for early detection of acute kidney injury and chronic kidney disease and FABP3, a diagnostic marker in cerebrospinal fluid of stroke patients.

"We have been able to identify some novel proteins which have implications in important diseases," adds Pandey. These proteins are cathepsin L2 (CTSL2) linked to chronic kidney disease, sialyltransferase 1 (ST6GAL1) for acute childhood leukemia, insulin like growth factor binding protein 4 (IGFBP4) for prostate, ovarian and gastrointestinal cancers, mucin-like 1 (MUCL1) for breast cancer, and neurocan (NCAN) for bipolar disorder. Pandey says this could serve as a reference list for future studies aimed at biomarker discovery.

References

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Nature India EISSN 1755-3180

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