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Possible test for liver cancer using technology for analysing rocks and minerals

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A group of clinicians and geochemists are working to develop a test for the most common form of primary liver cancer, HCC (Hepatocellular Carcinoma). HCC kills over 600,000 people worldwide every year. It usually develops from chronic liver disease such as hepatitis or cirrhosis, but there is no good biochemical test to indicate when the cancer develops, meaning that even for patients most at risk, it is nearly impossible to know when a cancer may develop until symptoms appear. Now a multi-national group of scientists are developing a new test for HCC, based on methods used to measure the stable isotope compositions of rocks and minerals.

Elements in nature tend to have different isotopes (the same number of protons, but different numbers of neutrons). So for example, in nature, 99% of the carbon is stable carbon-12, 1% is stable carbon-13, and radioactive carbon-14 occurs in trace amounts. This distribution of stable isotopes also occurs with other elements, such as copper and sulphur.

It has been known for some time that in cancer, the body's copper regulation can be affected. The researchers decided to look at whether the ratios of different copper isotopes varied between HCC patients and normal controls. They compared 23 male HCC patients with 20 controls; they found that the blood of patients with liver cancer had an enriched quantity of certain isotopes in comparison to control patients.

Comparing copper isotopes 65Cu and 63Cu, they found that HCC

patients have around 0.4 parts per thousand more 63Cu relative to 65Cu than the control patients. This difference was also seen with the Sulphur isotopes 32S and 34S, with blood of patients with HCC is around 1.5 parts per thousand richer in 32S relative to 34S than is normally found.

Group leader, geochemist Vincent Balter (Lyon, France) said: "The findings are interesting and potentially significant. We found that the ratio of 65Cu to 63Cu was higher in the blood of cancer patients than in the blood of controls. Preliminary results seem to show that these ratios are in fact reversed in the tumours themselves, which implies that there is a partition of isotopes between the blood and the tumour.

This opens the way for a blood test. At the moment the results are preliminary, but if we can confirm the validity of an isotopic test for HCC, this might have a significant impact on patients who have chronic liver disease, who risk developing liver cancer".

He continued: "There is increasing evidence that copper metabolism is significant in many cancers, and recently it has been found that copper chelation agents, which mop up copper in the body, can slow and perhaps even halt the growth of some tumours. What we have found may go some way to explaining some of the mechanisms of the growth of these tumours"

Speaking for the Goldschmidt conference, Associate Professor Rob Newton of the University of Leeds said: "This is an example of how techniques developed for one field can transfer to another. The type of isotopic analysis used by Balter and colleagues is commonly used in Earth Sciences, from studies on the Moon's formation to those on past changes in ocean and atmosphere chemistry.

I am excited by the idea that one could make isotopic mass balances between organs as we are used to doing between Earth reservoirs like the

mantle and crust. They will have, however, to face new difficulties, for instance a significant variability in the isotopic measurements, a common feature of biological samples, and to develop cheap, high throughput and user friendly methods for sample preparation and analysis. However, it's likely that we will continue to see exciting new applications of these isotopic techniques in other fields as this study shows."

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