Bob Barrett: This is the podcast from *'Clinical Chemistry'*. I am Bob Barrett. The advent of smartphone technology is revolutionizing much of the way we live and work. These handheld minicomputers house specialized applications or apps that have limitless possibilities and the science community is eager to unlock this potential. Could this technology allow a person to detect whether or not he or she has cancer?

A recent piece in the journal *'Science Translational Medicine'* detailed a smartphone app that is a micro-nuclear magnetic resonance device for the rapid molecular analysis of human tumor samples.

In the September issue of *'Clinical Chemistry'*, Dr. Eleftherios Diamandis, Head of Clinical Biochemistry at the Mount Sinai Hospital and the Division of Clinical Biochemistry and Head of the Department of Laboratory Medicine and Pathobiology at the University of Toronto critiqued this pioneering technology to evaluate its usefulness and performance. Dr. Diamandis is our guest in this podcast.

Doctor, do you really think that smartphones can play a role for more effective patient care?

Dr. Eleftherios Diamandis: A lot of physicians and experts agree that the smartphones will revolutionize the way we practice medicine today. In addition to the usual obligations of smartphones for telephone calls, scheduling, access to the Internet, etcetera, there are many other potential laboratory medicine obligations such as retrieval of reference ranges, unit conversions, medical calculations, such as ion gap, cardiac risk estimation, etcetera that are quite attractive.

It seems that it will soon be possible to review from a remote location, therapies, test results and images and make medical decisions.

Bob Barrett: Now what was the role of the smartphone in the diagnostic device described in the *'Science Translational Medicine'* paper?

Dr. Eleftherios Diamandis: In the case of the paper under discussion, the iPhone was a relatively minor player, merely controlling the diagnostic device which is called Nuclear Magnetic Resonance Machine, an operation that admittedly could also be performed more conveniently with a button on the machine.

Bob Barrett: Can you tell us briefly what was the purpose and innovation described in the *'Science Translational Medicine'* paper?

Dr. Eleftherios Diamandis: Yes, the purpose of that paper was to accurately diagnose cancer from fine needle biopsy aspirates by using a battery or quantitative measurements with a micro-nuclear magnetic resonance unit that also included micro-fluidics. The authors claimed that for plotting biomarkers measured in a quantitative fashion with this technology could correct the classified malignant from non-malignant lesions by using very small amounts of tissue.

Bob Barrett: When people hear about nuclear magnetic resonance, I imagine they think of instruments as big as an office building, is this the case with the NMR device used in this study?

Dr. Eleftherios Diamandis: Of course, the NMR device used in the study under discussion is a so-called the third-generation instrument and they also continuously improve it to make it very small. They want to use these 10 centimeters × 10 centimeters footprint and effectively, this device is smaller than a desktop telephone.

Bob Barrett: We understand that the authors were able to quantify a number of proteins for cancer lesion sub-classification, can you tell us a bit more about these proteins; were they novel proteins or known from the literature?

Dr. Eleftherios Diamandis: The proteins selected for this obligation are not new proteins, but rather proteins that are already known from the literature to be over-expressed in cancer. In this respect, this measurement of these proteins is novel, but not the proteins themselves.

Bob Barrett: How did the authors evaluate the performance of their device in clinical practice?

Dr. Eleftherios Diamandis: The authors evaluated the performance of their device in two phases. In the initial phase, they included 50 patients of which 44 had malignant lesions and six had benign lesions. Their four-marker combination correctly classified all 44 malignant lesions, yielding a sensitivity of 100%, and also correctly classified four out of six benign lesions yielding a specificity of 67% and an overall accuracy of 48 samples out of 50 or 96% accuracy.

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In the second phase, they included an addition of set of 20 samples of which 14 were malignant and 6 were benign and they correctly identified all of them which means an accuracy of 100%.

Bob Barrett: Well, how would you compare the success rate of the new method in comparison to standard care such as cytology and histology?

Dr. Eleftherios Diamandis: Well, they also compared their results with the standard of care which included conventional cytology and histology which in this case have an overall accuracy of 74% and 84% respectively. They also found one patient sample which goes then to contain only inflammatory cells by cytology whereas the migraine analysis and equivocally classified lesion is malignant and the patient was found to have a metastasis two months later. Taken together this data suggests that the new method did better than the standard of care.

Bob Barrett: Do you have any reasons to be concerned with this highly promising data?

Dr. Eleftherios Diamandis: Based on my experience of over 20 years, in the cancer biomarker field, I must say that I am always concerned with new and highly promising data because I have seen with my own eyes technologies failing over time with independent validations.

In this case, my concern is that some of the data reported seem to be too good to be true with precisions of their measurement sometimes below 1% which is practically unattainable and correlation coefficients between measurements that are extremely high.

Another major concern is that both their first and second patient validation groups had very few benign lesions which is six in the first phase and another six in the second which are really too few to drove definitive conclusions on the specificity of their method.

Consequently, with such low numbers, it is really not possible to categorically say if the method will work in real clinical situations.

Bob Barrett: Well, then do you believe this method is ready or not ready for clinical use and why?

Dr. Eleftherios Diamandis: Their method is not ready for clinical use because it has not been validated extensively by others either in a single or multi-standard price. This is a proof of principal obligation which is at least in my opinion two years away from clinical practice if all external validations are successful.

Bob Barrett: Well, what would you need to see done before you sponsor this promising method for routine clinical use?

Dr. Eleftherios Diamandis: Before the method is used to clinical practice, it should be validated by independent investigators in multi-centered trials including much larger number of patients with both malignant and benign diseases. Only when this done and if the data is still promising I will recommend this method for routine use.

Bob Barrett: Dr. Eleftherios Diamandis is the Head of Clinical Biochemistry at the Mount Sinai Hospital and the Head of the Division of Clinical Biochemistry and Department of Laboratory Medicine and Pathobiology at the University of Toronto. He's been our guest in this podcast from *'Clinical Chemistry'.*

I am Bob Barrett. Thanks for listening!

Total Duration: 9 Minutes