Early Detection of Lung Cancer Using Stochastic Sensors– A Screening Test for Life

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Lung cancer became one of the major causes of death due to lack in screening methods for its early detection. Causes of lung cancer are supposed to be connected with the smoking, but what about the patients diagnosed with lung cancer that never smoke! Due to the fact that lung cancer symptoms are common with those of other diseases, the lung cancer is detected in stages 3 or 4, by chest X-Ray, stages on which the chances of survival for the patients are extremely low.

In these conditions, screening tests are essential for early detection of lung cancer. Screening means testing people for early stages of an illness before they have any symptoms. For screening to be useful the tests: (1) must be reliable at picking up the illness; (2) must be simple and quick; (3) overall must do more good than harm to people taking part. One should also mention that the screening tests are not diagnostic tests, but essential tests in early signaling any problem on a certain part of the human body.

Low dose CT scans are being looked as a possible screening test for lung cancer, but tests like this have risks like - the lungs are very sensitive to radiation and frequent scans might cause lung damage. Chest exposure to X-ray means also an exposure to radiation which cannot be done so often. Furthermore, X-ray, CT (Computed Tomography), PET (Positron Emission Tomography), bronchoscopy, sputum cytology and bronchial biopsy are not effective in early diagnosis of lung cancer. However, ability to use these techniques is dependent on the size of tumor and some special medical equipment, leading to an increasingly cost. Several biochemical methods for the detection of lung cancer are also used clinically by detecting biomarkers released by cancer cells or lung tumors into the serum/plasma/blood, but the usual standard methods are not sensitive enough to detect the concentration of biomarkers at a very low level - at which the tumor is just forming, actually the level corresponding to asymptomatic patients.

Minim invasive screening tests are the most appreciated, and therefore Stefan-van Staden proposed a new test based on biomarkers detection in a drop of blood [1-7]. The biomarkers selected to date to indicate the presence of lung cancer were CEA, HER-1, NSE, CYFRA 21-1 and TNF-α [8-10]. The tests were performed with minimum costs, using various stochastic sensors based on diamond paste modified with different dextrins, porphyrins, as well as stochastic sensors based on metallic materials like gold, nickel and copper. The advantages of using this test are: (1) no sample processing is needed – the drop of blood can be used as collected from the patient; (2) the analysis is taking place within minutes, and it is minimum invasive; (3) it is cost effective – first of all because the materials for the sensor used in the measurement are not expensive, and second because the same sensor can determine more than one biomarker; (4) the biomarkers can be identified reliably and also their concentration can be measured with high precision. We did more than 50 screening tests for confirmed patients, and more than 100 screening tests for volunteers that want to check their state of health. A good correlation was obtained between the data of the screening test and data obtained using further tests used for lung cancer diagnosis. Besides all the data, the most important thing was that 20 of the volunteers, were confirmed with lung cancer in a very early stage, the stage free of symptoms. This proved that the test may be of great use for early detection and saving life. For other patients, the test identified the biomarkers mentioned

above, and further tests indicated that there are other associated pulmonary diseases which they treated and the patient (not being aware of the illness) was cured in a shorter time with minimum cost.

Because the detected biomarkers can also indicate other pulmonary diseases, to get closer with the diagnosis of lung cancer, we intend to add more biomarkers identified recently as relevant for lung cancer, to this test. Nevertheless, using such screening test can making both the medical doctor and patient aware of pulmonary diseases associated with the presence of biomarkers, at a very early stage, making possible a faster diagnosis of pulmonary diseases by performing further tests used in diagnosis, curing faster the patient, saving money (needed for a late diagnosis for medication, and other procedures used for their treatment). I believe that by making these screening tests available at a very low cost, one should contribute to the decreasing of the mortality due to pulmonary diseases, especially due to lung cancer.

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