Abstract:

To reduce the significant disability, suffering, and deaths, caused by liver cancer worldwide, effective and affordable technologies for early diagnosis, screening, and treatment are needed. Although early diagnosis of liver cancer increases the available treatment options, common methods used for surveillance are not enough sensitive.

Taby diagnostics provides a high throughput and reliable in vitro platform for serum autoantibody-like biomarker identification and quantification. Because autoantibodies are often detected many years before the onset of the disease, and show remarkable specificity, they are considered potential biomarkers for early diagnosis and personalized treatment. However, new methods to increase the sensitivity to detect autoantibodies are needed before using them as good and reliable biomarkers for early diagnosis of liver cancer.

Our platform is based on a new and innovative technology developed to modify antigens to increase their immunogenicity. With this method, we have demonstrated to increase the sensitivity (from 52% to 93%, when compared to the standard test) to detect autoantibodies against alpha-fetoprotein. Thanks to this technology we will be able to double the amount of patients with liver cancer that survive.

Problem:

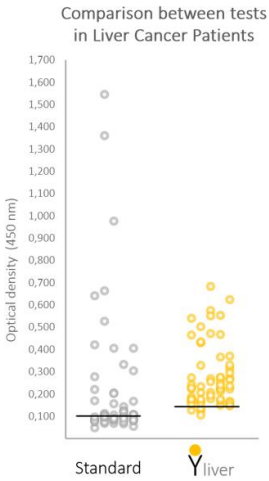
Liver cancer is the second leading cause of cancer-related death in the world with nearly 750,000 deaths in 2012. This cancer is highly prevalent, with more than 700,000 new cases per year worldwide, and a very low probability of being effectively treated when diagnosed at late stages. With early diagnosis, cure is possible in 30% of cases, and in the rest, effective control is achievable. However, liver Cancer is asymptomatic in the early stages and therefore diagnosis generally occurs when the disease has progressed to an advanced stage.

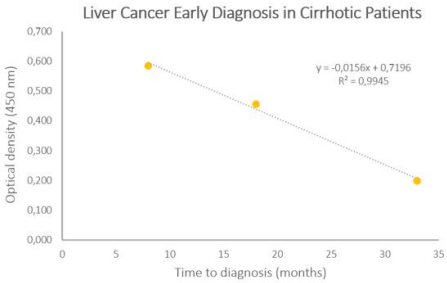
Liver cancer surveillance has been indicated for patients at high risk of developing this disease. The primary risk factor for liver cancer is liver cirrhosis, which contributes to 70–90% of all liver cancer cases worldwide. Therefore, cirrhotic patients may be enrolled in surveillance programs, which considerably improve the chances of detecting liver cancer at an earlier stage. Common methods used for surveillance include, ultrasound, and the detection of biomarkers such as alpha-fetoprotein (AFP). Elevated AFP levels are linked to poor prognosis; however, only approximately half of patients have elevated AFP levels at point of diagnosis, making it unsuitable as a standalone in vitro method for liver cancer surveillance. Therefore, there is the need to develop a standalone, high-throughput, and cost-effective diagnostic test enough sensitive to early diagnose and surveil patients with liver cancer.

Solution:

Our invention consists of a high throughput and reliable in vitro platform for serum autoantibody-like biomarker identification and quantification. This platform is based on a technology that increases the immunogenicity of antigens in the most popular and high throughput assay (ELISA test) for protein detection and quantification, therefore increasing the efficiency and sensitivity to detect serum auto-antibodies.

At present, we have used our buffer to quantify auto-antibodies against alfafetoprotein (AFP), the gold standard biomarker for the diagnosis of hepatocellular carcinoma (HCC). The ELISA test performed with our technology increased the sensitivity to diagnose HCC to 93% compared to the current 53% (see left graph below) obtained when performing the gold standard technique. An additional experiment with patients at high risk to develop HCC (ie: Cirrhosis), have importantly demonstrated that this method could be also used as an affordable screening tool to early diagnose HCC (see right graph below).





Impact:

Liver cancer treatments can be curative when applied to patients with early-stage tumor. Early detection programs in Europe, USA and Asia recommend a biannual ultrasound test in high-risk patients. It has been estimated that 60-70% of patients enrolled in surveillance programs receive curative treatment for liver cancer, while only 20% of patients receive this curative treatment when they do not enter the program. Although the cost-effectiveness of these early detection programs has been demonstrated in numerous studies, their sensitivity is still low. Improving the sensitivity of the screening program would increase the percentage of the population at risk who would receive a curative treatment, as well as its economic and social impact. With our technology, we are able to increase the sensitivity of AFP autoantibody detection from 53% to 93%, along with a 97% specificity.

In Spain, the prevalence of liver cirrhosis is 0,3% where 35% of these patients are screened for liver cancer. Therefore, the market for early diagnosis of liver cancer in Spain is approximately of 50,000 patients per year. If Taby technology were applied, thanks to the high sensitivity of our diagnostic test, we could double the amount of patients to access treatment options.

Next steps:

1- Design a proof of feasibility: This proof of feasibility is based in a multicenter prospective cohort study. One cohort will be composed of patients at risk for liver cancer (cirrhotic patients) and another cohort will be composed of patients with liver cancer who received treatment. Results from our test will be used to further demonstrate its

suitability as a highly sensitive and reliable test to early diagnose liver cancer as well as to determine the effectiveness of treatments applied to these patients.

2- To obtain advice on how to protect and exploit our invention: We are aware that our technology, if publically available, can be easily reproducible by our potential competitors and therefore difficult for us to find the right tools to avoid them doing it. Although we have written a patent, after talking with some key opinion leaders, we are still not sure whether it is better to submit the patent or keep it as a trade secret.

3- To define our business model according to the protection used: We need to define how are we going to exploit our technology, and then identify partners, competitors, clients, resources needed, regulatory needs, and investment required.

4- To develop a plan to seek investment or to obtain revenues: Regarding the business strategy defined, we will develop a financial plan and a fundraising strategy.

5- To create a spin-off to offer Taby test to Hospitals.

TEAM:

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