MEDICAL INNOVATION: CYSTIC FIBROSIS DIAGNOSTIC TEST STRIPS (MEDICAL DEVICE: DIAGNOSTIC)

Physician: Dr. Wayne Grody
Industry: Quest Diagnostics

Situation

An inherited disease with no genetic test

Cystic fibrosis is an inherited chronic disease that affects the lungs, mucus glands and respiratory systems of some 30,000 Americans. The disease causes especially thick secretions of mucus that result in a variety of respiratory infections and complications, and historically has led to a much lower life expectancy. It is one of the most commonly inherited disease among Caucasians, striking one in 2,500 to 3,000 newborns annually in the U.S., according to the National Institutes of Health (NIH).

Although there is no cure for cystic fibrosis, advances in healthcare have made the disease much easier to manage. The Cystic Fibrosis Foundation notes that in the 1950s many children with the disease would see their high school years, whereas today those with the condition live into their 30s, 40s and beyond. That said, since cystic fibrosis is passed to children through the genes of their parents – often when neither parent has the disease – many have long been interested in a simple test that would allow them to determine the likelihood of their children acquiring it.

Physician-Industry Collaboration

Work on a complex gene yields a simple test

The Advanced Medical Technology Association (AdvaMed) describes Dr. Wayne Grody's singlehanded pursuit of a genetic breakthrough that would produce such a test: As a child, he was fascinated by a Life magazine cover featuring an image of DNA's double helix structure. That fascination led Dr. Grody to a career in the field of genetics and diagnostic molecular pathology.

In 1992, Dr. Grody, then a professor of medical genetics and molecular pathology at University of California Los Angeles (UCLA) School of Medicine, was approached by the Human Genome Project (HGP), which was seeking to apply the growing knowledge of genetics to improve understanding of complex diseases. HGP asked Dr. Grody to help determine the likelihood, based on the parents' genetic profile, of a child being born with cystic fibrosis. The gene for cystic fibrosis had been discovered in 1989 and, according to Dr. Grody, was "extremely large and complex." With his team at UCLA, Dr. Grody spent five years studying genetic mutations indicating that a parent has the cystic fibrosis gene. The team focused on the six most common mutations to come up with a DNA-based test, ultimately producing an oral swipe test.

They studied the test among pregnant women, screening them for the cystic fibrosis gene and, if positive, also screening the father. To evaluate the oral swipes, Dr. Grody worked with a diagnostic test manufacturer, Quest Diagnostics, to create and refine a test strip with DNA probes that scanned for each of the six genetic mutations. In 1997, the team presented its work to a panel at the NIH, which subsequently recommended that the cystic fibrosis test should be offered to all pregnant women.

Innovation Benefits

A significant decrease in cystic fibrosis among newborns

Since then, according to AdvaMed, Dr. Grody has continued to work with the diagnostic company to improve the test by scanning for 23 different cystic fibrosis genetic mutations. The test is now performed with a blood sample, which has improved its sensitivity and accuracy. Dr. Grody continues to refine the cystic fibrosis test, and he also works with the Centers for Disease Control and Prevention to create "control" cells carrying mutations for a variety of diseases for use as quality control materials in genetic molecular testing.

While some have pointed out that the ability of parents to determine whether they carry genes of a particular disease can present ethical issues involving family planning, the test has become increasingly popular in the U.S. and Europe, and a number of studies conclude that the availability of a reliable genetic test has resulted in a significant decrease in the incidence of cystic fibrosis among newborns.

Patient Benefits

An aid in family planning

PBS's *Our Genes, Our Choices* project describes one couple's use of the genetic cystic fibrosis test to help it make family planning decisions:

Since Shelley and David were planning to start a family, they decided to request genetic testing for cystic fibrosis given how common it is among Caucasians. David's 24-year-old sister had the disease, but while Shelley had no family history of cystic fibrosis, she was surprised when test results showed her to be a carrier of the disease.

Also surprising was the fact that David, whose family history gave him a 66 percent chance of being a carrier, tested negative. At this point, a blood sample was obtained from his sister, who turned out to have only one identifiable cystic fibrosis mutation. A second, unidentifiable mutation had to be present to cause her illness.

Was David a carrier of his sister's unidentifiable CF mutation? If so, he and Shelley would have a 25 percent risk of having a child with cystic fibrosis. Because the second mutation was unknown, the severity of the disease could not be predicted. Testing David's parents did not resolve his carrier status either. After weighing all these factors, the couple came to the difficult decision to achieve a pregnancy using donor sperm.