

ORIGINAL RESEARCH

Biomarker Testing



Support • Empower • Advocate

Introducing ALK Positive Lung Cancer (UK) – a vibrant, active and determined community dedicated to helping every person diagnosed with this rare, currently incurable, cancer to receive the best care possible and live their best life for as long as possible.

The charity has one fundamental goal: to extend the overall survival and quality of life of ALK-positive lung cancer patients across the UK. ALK Positive Lung Cancer (UK) was established in 2018 by patients, their families and friends. Our journey began as a social media patient support group, and we have grown to become a well-respected and trusted source of ALK-positive lung cancer information. We are recognised by the National Institute for Health and Care Excellence (NICE) as an organisation to be consulted on new ALK-positive treatments.

Today, ALK Positive Lung Cancer (UK) provides an invaluable platform where patients and their families can exchange information about their diagnoses and treatments, and give and receive mutual support.

The charity is a primary source of information to inform and empower patients about their disease, available treatments and best-practice disease management.

We advocate on behalf of ALK-positive patients to ensure that they receive the highest level of care, whatever their demographic and wherever they live in the UK.

Biomarker Testing

Biomarker testing is an important part of precision medicine. Precision medicine is an approach to medical care in which disease prevention, diagnosis and treatment are tailored to the genes, proteins and other substances in your body.

For cancer treatment, precision medicine means using biomarkers and other tests to select treatments that are most likely to help you, while sparing you from receiving ineffective treatments.

The idea of precision medicine isn't new, but recent advances in science and technology have helped speed up the pace of this area of research. Scientists now understand that cancer cells can have many different changes in genes, proteins and other substances that make the cells grow and spread. They have also learned that even two people with the same type of cancer may not have the same changes in their cancer. Some of these changes affect how certain cancer treatments work.

Even though researchers are making progress every day, the precision medicine approach to cancer treatment is not yet part of routine care for most patients. But it is important to note that even the "standard" approach to cancer treatment (selecting treatments based on the type of cancer you have, its size and whether it has spread) is effective and is personalised to each patient.

WHAT IS BIOMARKER TESTING FOR CANCER TREATMENT?

A biomarker is a sign of disease or abnormal function that can be measured in your blood, tissue or bodily fluid. In cancer, biomarkers are often used to help choose the best treatment for you. These biomarkers can be proteins, genes or gene mutations. Biomarkers are often referred to by a three- or four-letter abbreviation. Examples of biomarkers are HER2 in breast cancer or ALK in lung cancer.

Biomarker testing can help to diagnose or identify the type of cancer you have. A biomarker can also be referred to as a marker, tumour marker, genomic marker, signature molecule or molecular diagnostic.

Biomarker testing can be used to look for mutations in a cancer (called somatic mutations). Somatic mutations cause most cancers and can't be passed on to family members.

This is different from genetic testing, which looks for mutations in your genes that are inherited from your parents and can be passed on to children. The latter is not covered in this resource.

WHY ARE BIOMARKERS TESTS USED IN ONCOLOGY?

Biomarker testing can help identify a specific mutation in a cancer cell, reveal the "drivers" that can cause cancer to grow in different ways, or predict how well your body responds to certain types of treatment. More specifically, biomarker testing can be used in oncology to determine:

- **Risk (also called susceptibility):** to help assess how likely you are to develop cancer or determine whether you should undergo more intensive screening.
- **Diagnosis:** to help detect or confirm a disease or condition.
- **Prognosis:** to forecast how your cancer will progress in the absence of therapy.
- **Prediction:** to help assess whether you will respond to treatment.
- **Response:** to help predict your response – both beneficial or harmful – to a certain treatment.
- **Monitoring:** to help determine how you are doing over time, either on or off treatment.
- **Safety:** to help measure the likelihood, presence or extent of side effects before or after undertaking a treatment.

Knowing your cancer's biomarkers can help you and your healthcare team make fully informed decisions about your treatment. Ask your healthcare team about biomarker testing at any decision point before new treatment begins, including upon diagnosis, recurrence or progression.

Keep in mind that even when a cancer biomarker is present, there is no guarantee that a targeted therapy will work against your cancer. One reason for this is that the molecular make-up of cancer can change over time. This means that the target molecule of the biomarker can change. The tumour can also find ways to grow and spread without that molecule. If a drug stops working or your cancer returns, that may mean that your tumour cells have become resistant to a treatment. At that point, another biomarker test may be needed to understand how your tumour has changed. This could identify new biomarkers that may be targeted for treatment.

WHAT IF BIOMARKER TESTING IS PERFORMED?

Biomarker testing can be done on both primary tumours and metastatic tumours. If the tumour sample is too small to run through multiple tests, priority should be given to testing for mutations that are the most likely to be present, have a NICE-approved drug treatment, or otherwise help with treatment decisions.

Liquid biopsy

If you are having a biomarker test known as a liquid biopsy, you will need to have a blood draw. You might be given a liquid biopsy test if you can't safely have a tumour biopsy, for example, because your tumour is hard to reach with a needle, or if you have a health condition that prevents you from undergoing the procedure. For some cancer types, a liquid biopsy can detect cancer cells of a tumour circulating in the blood, or pieces of the tumour's DNA circulating in your blood. Keep in mind, however, that not all cancers shed cells into the bloodstream in the same way. Therefore, a liquid biopsy may only be useful for detecting or monitoring certain cancers. In many cases, tissue biopsies may be more accurate than liquid biopsies.

WHAT HAPPENS AFTER I'VE BEEN TESTED?

Your samples will be sent to a lab where they will be tested for certain biomarkers. The lab will create a report that will show if any biomarkers were identified in your cancer cells that may be helpful in selecting the right treatment approach for you. Ask your healthcare team how long it will take for them to get the results.

It is a good idea to request a copy of your biomarker testing report for your own information and to have it available to show to other healthcare providers, if necessary.

DO I HAVE THE RIGHT TO BIOMARKER TESTING?

As a patient, you have the right to:

- **Receive optimal care and engage in shared decision-making** with your healthcare team when discussing your personalised treatment plan.
- **Access and understand your biomarker test results**, which have critical information about whether you may respond to treatment.
- **Request a print or electronic copy of your biomarker testing report** for your medical records; they can be helpful in seeking a second opinion.
- **Seek a second opinion** about your treatment options.

WHAT QUESTIONS SHOULD I ASK MY HEALTHCARE TEAM BEFORE AND AFTER BIOMARKER TESTING?

Understanding diagnostic procedures

- What diagnostic tests do you recommend for my condition and why? What can the test results tell me about my condition?
- What will the tests involve? Are they available to me? How much time/energy will it require from me?
- When and where will I have my testing completed? Will all testing be completed now or will some be done later?
- Is there a waiting period to have any tests done? How long will it take to get the results?
- How will I be given my results? Who can help me understand them? Can I have a copy of my test results?

Understanding treatment options

- Which treatment or combination of treatments would you recommend for me and why?
- Are there other treatment options available, such as clinical trials? How can I access them and what do they involve?

- What does each treatment aim to do and how effective is it likely to be? Is there anything I can do myself to help?
- Do I need to have further tests before initiating the treatment? Will I have to wait to get all the test results back before starting treatment?
- When will the treatment start? Is there time to wait and see, and time for me to consider my options?
- What are the potential side effects of the recommended treatments? How might they affect my quality of life? What can we do to manage them?
- Will the recommended treatment interact with other medications I am taking for my condition or vice versa? How can we manage this?
- How do I take my treatment and how often? How long will it last?
- I would like to get a second opinion before I commit to my treatment plan. Can you suggest a suitable specialist?
- Is there any psychological/social/emotional support or tools available during my treatment to support me and/or my family members?
- Will I need to contribute financially towards my tests? If so, are there financial assistance programs or resources you can recommend (in countries where relevant)?

HOW DO I GET ADDITIONAL RESOURCES AND SUPPORT?

You might like to contact the charity ALK Positive Lung Cancer (UK) via their website at www.alkpositive.org.uk.

GLOSSARY OF COMMON BIOMARKER CANCER TESTING TERMINOLOGY

- **Biomarker:** a sign of disease or abnormal function that can be measured in your blood, tissue or bodily fluid. In cancer, biomarkers are often used to help choose the best treatment for you. These biomarkers can be proteins, genes or gene mutations. Biomarkers are often referred to by a three- or four-letter abbreviation. Examples of biomarkers are HER2 in breast cancer or ALK in lung cancer (Cancer Support Community, Precision Medicine Plain Language Lexicon).
- **Biomarker testing** (also referred to as comprehensive biomarker testing, gene-based cancer testing, genetic testing of the cancer, cancer marker testing, next-generation sequencing, genomic profiling, mutation biomarker testing, genomic testing, molecular profiling, tumour marker testing, mutation testing and molecular testing): biomarker testing helps your doctor match the right drugs to the specific subtype of cancer you have. In biomarker testing, a sample of your cancer is collected from your blood, bodily fluids or tissue taken during surgery or biopsy. Your sample is sent to a lab. The test looks for biomarkers in your cancer sample. The test results can be used to help guide your treatment options. Biomarkers tell your doctor about the subtype of the cancer in your body (Cancer Support Community, Precision Medicine Plain Language Lexicon).
- **Diagnostic test:** a type of test used to help diagnose a disease or condition (National Cancer Institute Dictionary of Cancer Terms).
- **Genetic testing:** the process of analyzing cells or tissue to look for changes in genes, chromosomes or proteins that may be a sign of a disease or condition, such as cancer. These changes may also be a sign that a person has an increased risk of developing a specific disease or condition. Genetic testing may be done on tumour tissue to help diagnose cancer, plan treatment or find out how well treatment is working (National Cancer Institute Dictionary of Cancer Terms).
- **Liquid biopsy (also referred to as fluid biopsy):** a biomarker test done through bloodwork. It tests tumour DNA or tumour cells found circulating in your blood. Your doctor may choose to do a liquid biopsy, since it only needs a sample of blood. If a liquid biopsy comes back with a positive result, your doctor can use those results to choose treatment. If test results are negative, your doctor may want to do a tissue biopsy (Cancer Support Community, Precision Medicine Plain Language Lexicon).
- **Secondary tumour (also referred to as metastatic tumour):** a term used to indicate the spread of cancer from the primary site (place where it started) to other places in the body (National Cancer Institute Dictionary of Cancer Terms).
- **Mutation in the cancer:** two kinds of mutations can be found in cancer cells – mutations you inherit and mutations you acquire during your lifetime (called somatic mutations). Inherited mutations are found in all your cells. Acquired mutations may only be found in the cancer cells. Acquired mutations happen as you get older and are the result of the wear and tear of life. These mutations are not inherited and cannot be passed on to children. Mutations in the cancer can affect how it grows and spreads. These mutations can also define the cancer's subtype. Mutations in the cancer can be a type of biomarker. A biopsy sample or liquid biopsy is needed to test for mutations in the cancer (Cancer Support Community, Precision Medicine Plain Language Lexicon).
- **Precision medicine:** a form of medicine that uses information about a person's own genes or proteins to prevent, diagnose or treat disease. In cancer, precision medicine uses specific information about a person's tumour to help make a diagnosis, plan treatment, find out how well treatment is working, or make a prognosis (National Cancer Institute Dictionary of Cancer Terms).

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- **Primary tumour:** a term used to describe the original, or first, tumour in the body. Cancer cells from a primary tumour may spread to other parts of the body and form new, or secondary, tumours. This is called metastasis. These secondary tumours are the same type of cancer as the primary tumour. Also called primary cancer (National Cancer Institute Dictionary of Cancer Terms).
 - **Side effect (also referred to as adverse event):** a problem that occurs when treatment affects healthy tissues or organs. Some common side effects of cancer treatment are nausea, vomiting, fatigue, pain, decreased blood cell counts, hair loss and mouth sores (National Cancer Institute Dictionary of Cancer Terms).
 - **Tissue biopsy:** when cells or tissues are removed and sent to a lab to see whether cancer is present. Biopsies require surgery or a needle to remove the cells or tissues. Samples from tissue biopsies can be used to test for biomarkers in the cancer (Cancer Support Community, Precision Medicine Plain Language Lexicon).

ACKNOWLEDGEMENTS

This resource was co-created by a global, multi-stakeholder working group of the **From Testing to Targeted Treatments (FT3)** programme.

FT3 brings together diverse stakeholders and activities in precision medicine to identify shared needs, build on existing good practices and learnings, and make them replicable through practical and actionable tools and resources for precision medicine champions to drive real change and impact, starting with cancer and testing.

Ultimately, the goal is to develop integrated and optimised resources for different stakeholders to improve access to precision medicine, and to develop a positive momentum to be able to improve patient outcomes and experiences.

This guide is the result of the aggregation of resources originally developed by LUNGeivity, Lung Cancer Europe, the National Cancer Institute, Research Advocacy Network, Cancer Support Community and others, which emerged as good resources in terms of scientific credibility, patient centricity, plain language and ease of use. We thank them for their good practice inspiration.



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For further information, please visit www.alkpositive.org.uk