Muscle biopsies

What is a muscle biopsy?

A muscle biopsy is a procedure in which a small sample of muscle – usually about the size of an orange pip – is taken and examined under a microscope. It is considered to be a 'minor' procedure, and is usually done in outpatients under local anaesthetic or as a day case under local or general anaesthetic. A doctor usually requests a muscle biopsy to help with diagnosis after a physical examination, blood tests, and possibly an electromyography (EMG).

What does it involve?

A muscle biopsy can be taken from any of a number of different muscles – most commonly your thigh, upper arm, shoulder or calf muscles. Your doctor will take the sample from muscle that is affected by your suspected condition, but is not severely wasted. The muscle will re-grow in time. A muscle biopsy does not increase any muscle weakness.

There are two different types of muscle biopsy.

1. Needle biopsy

   A needle biopsy involves inserting a needle, about 5mm in diameter, into your muscle. When the needle is removed, it has inside it a small sample of muscle that is taken for analysis.

   The needle biopsy scar is very small, and is closed with sterile strips and a plaster. You won't need stitches. A needle biopsy is a specialised procedure and is only performed in outpatients or as a day case at a few centres in the UK.

2. Open biopsy

   An open biopsy involves making a cut in your skin to remove a muscle sample. The cut is usually just a few centimetres long. Once the sample is taken, the cut is closed with stitches. The scar from an open biopsy is bigger than from a needle biopsy, because a bigger muscle sample has been removed. A bigger sample is sometimes necessary and makes it less likely you will need a second biopsy.

Both types of biopsy have advantages and disadvantages. Different hospitals often prefer to use different methods.

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Are there any risks with muscle biopsies?

The risks associated with muscle biopsies are very small. There is a very small risk of muscle damage and infection, and you'll often have a patch of numbness around the scar, which may last for a few weeks.

Is there an alternative to a muscle biopsy?

A muscle biopsy is a standard procedure when doctors are investigating whether you might have a muscle-wasting condition.

Molecular genetic testing is available for some conditions so in those cases a muscle biopsy may not be necessary. Doctors usually rule out any of these conditions first by analysing a blood sample. They will then decide whether or not to do a muscle biopsy too.

What happens to the muscle sample?

Your muscle sample is sent to the laboratory, where most of it is frozen. Very thin slices are cut and stained with various dyes and examined under a microscope.

A small piece of your muscle sample may be put in a preservative so it can be examined at very high magnification using an electron microscope (see Electron microscopy below).

Some of the muscle sample may also be used for other types of studies, which also help to explain what is happening inside your muscle. If you agree, any parts of the sample which have not been used can be stored so they can be studied for research purposes.

The pathologist who analyses your muscle sample will examine it in different ways depending on which muscle-wasting condition your doctor suspects you may have.

Histology

This involves looking at the overall appearance and structure of your muscle cells so the pathologist can look for characteristics that are specific to certain conditions. The muscle is dyed using various chemicals so the different structures show up under the microscope.

Histochemistry

This technique also uses chemical dyes, but looks at the activity of chemicals within your muscle fibres, which is important when diagnosing metabolic disorders. Histochemistry also reveals the characteristics of your muscle fibres. Certain changes can help to identify particular conditions.

Immunohistochemistry

This procedure uses antibodies that bind to a specific protein and can show the presence or absence of important proteins within the muscle. When antibodies are tagged with a marker, they can be seen under the microscope and can show if a protein is in the wrong place, or is absent or reduced in amount. This is important for several muscular

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dystrophies, such as Duchenne muscular dystrophy, which is caused by the absence of the protein dystrophin.

Electron microscopy

Electron microscopy allows high magnification of each muscle cell, making it easier to see structural abnormalities. This is relevant for conditions such as nemaline myopathy, where the diagnosis is based on the presence of rod structures in the muscle. Some abnormal features are visible only with the high magnification provided by electron microscopy.

What are pathologists looking for?

Appearance of fibres

Healthy muscle has a characteristic appearance, and is made up of closely-packed fibres, which are more or less evenly sized (Figure 1).

Muscle affected by a muscle-wasting condition looks different from normal muscle (Figure 2). These differences vary between conditions.

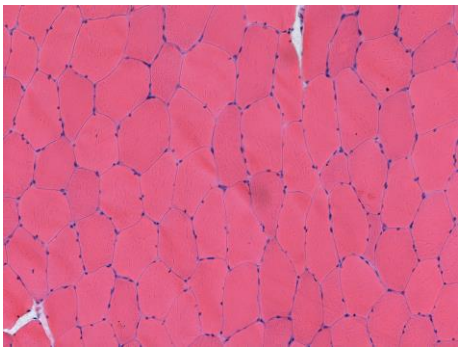

Figure 1: Healthy adult muscle biopsy

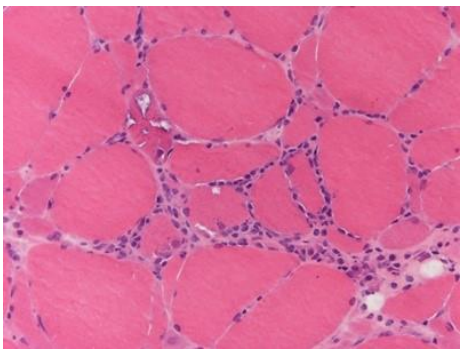

Figure 2: Muscle biopsy from a patient with Inclusion body myositis

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There are two types of muscle fibre: type 1 and type 2. In some conditions, the muscle fibres are smaller or larger than they should be. They may be damaged, or the proportion of type 1 to type 2 fibres may be unbalanced. In some cases, only one type of fibre may be affected.

Important proteins

Muscle fibres are built from a number of different, essential proteins. If some of these proteins are missing, in the wrong place, or there are too many or too few of them, this may cause problems with the muscle.

Buildup of substances in your muscle

There are many different chemical pathways within muscle tissue that can be affected in muscle-wasting conditions. These result in changes in the amounts of key substances in your muscle.

One example of this is glycogen, which is an important energy storage molecule. In healthy muscle, glycogen is broken down by a pathway involving several proteins called enzymes. Enzymes control the speed of chemical reactions in your body, but in some muscle-wasting conditions, one of these enzymes is missing or abnormal. This results in a build-up of glycogen in your muscle, which can be seen under the microscope with certain histochemical dyes. Special biochemical studies may be needed to identify the exact problem. A build-up of certain proteins in muscle fibres can occur in some conditions, and these can be identified by certain antibodies.

Structural changes

Some conditions are diagnosed by the presence of structural abnormalities within the muscle. For example, muscle affected by core myopathy (including central core disease and multiminicore disease) has characteristic core structures. In mitochondrial myopathies, structures called mitochondria, which convert food into energy, contain faulty proteins that disrupt their function. These can sometimes be seen under a microscope, or revealed with special biochemical studies.

Distribution

It is important to look at the distribution of any abnormalities within the muscle. This can sometimes, but not always, give an indication of the severity, and the rate of progression of a condition.

How long does it take to get the results?

How long you will have to wait for your results will depend on the number of tests to be done and the date of your next appointment with your consultant. Results can be made available more quickly, if necessary.

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When your consultant has received the results of your muscle biopsy, they will invite you to an appointment to discuss the results and the follow-up. What happens next depend on the results of your tests. Your consultant will discuss this with you.

References

- Figure 1 and 2 supplied to us by Professor Janice Holton, UCL Institute of Neurology

We're here for you at the point of diagnosis and at every stage thereafter, and can:

- give you accurate and up-to-date information about your or your child's muscle-wasting condition, and let you know of progress in research
- give you tips and advice about day-to-day life, written by people who know exactly what it's like to live with a muscle-wasting condition
- put you in touch with other families living with the same muscle-wasting condition, who can tell you about their experiences
- tell you about – and help you get – the services, equipment and support you're entitled to.

If you have feedback about this factsheet or would like to request any references used to produce it, please email info@musculardystrophyuk.org.

Here for you

The friendly staff in the care and support team at the Muscular Dystrophy UK's London office are available on **0800 652 6352** or **info@musculardystrophyuk**.org from 8.30am to 6pm Monday to Friday to offer free information and emotional support.

If they can't help you, they are more than happy to signpost you to specialist services close to you, or to other people who can help.

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