

*Pancreatic Cancer*

**WHAT'S  
WRONG  
WITH  
MY  
PANCREAS**

*A guide for patients*

**3<sup>rd</sup> Edition**

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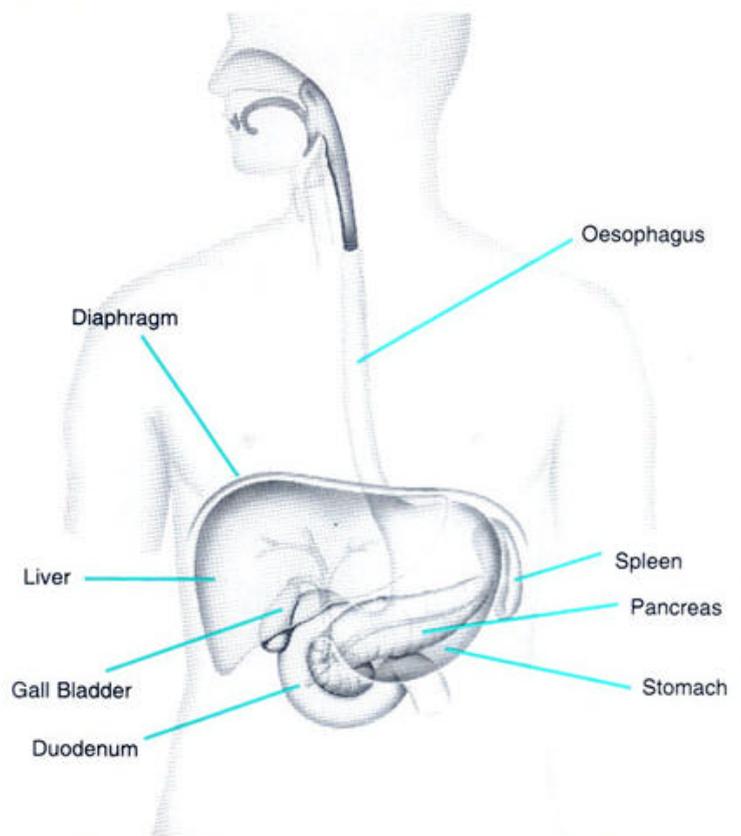
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## INTRODUCTION

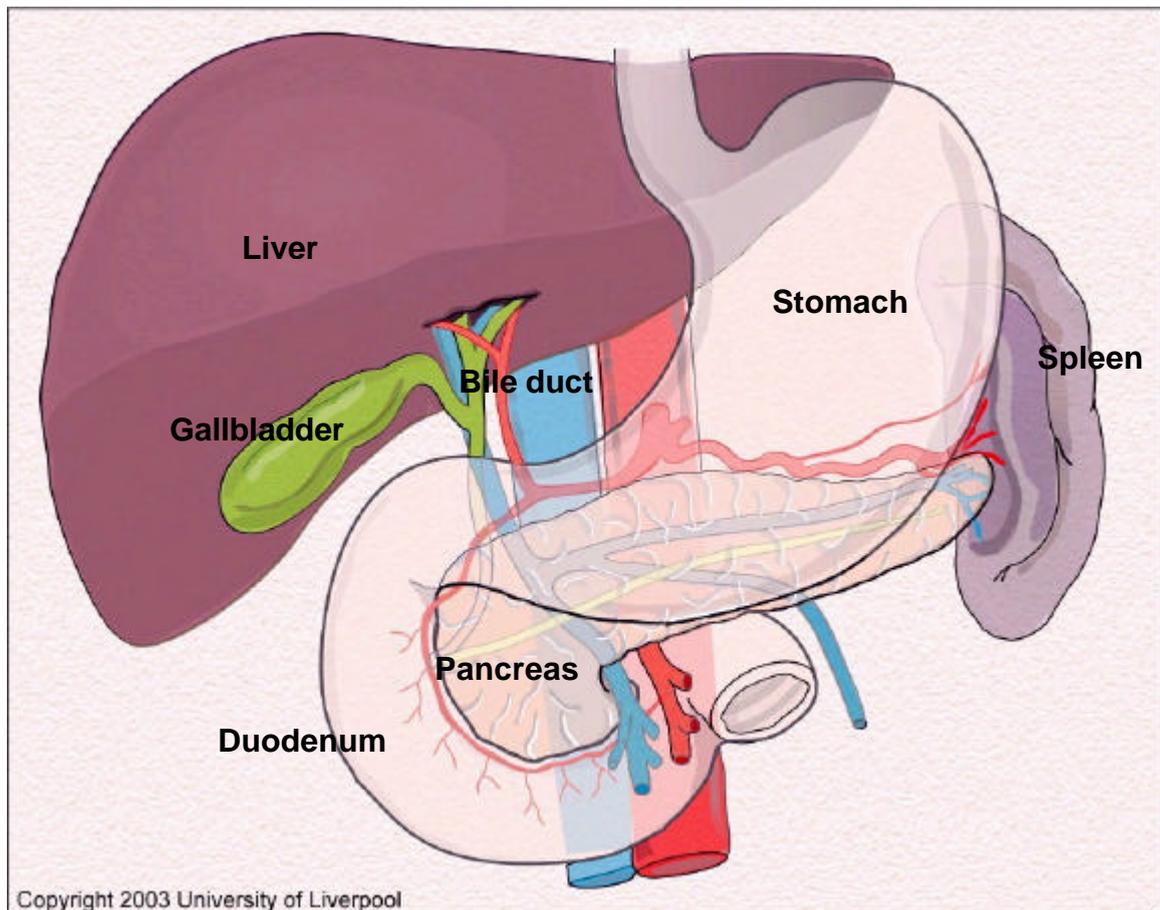
This is a series on pancreatic disorders written by Professor John P. Neoptolemos. Its aim is to provide you, the patient, with useful information on the particular pancreatic problem you are suffering from, the procedures and tests you may need to undergo, and helpful advice on coping successfully with the problem. If you require any further information or advice or are unsure about anything, your doctor will be able to help.



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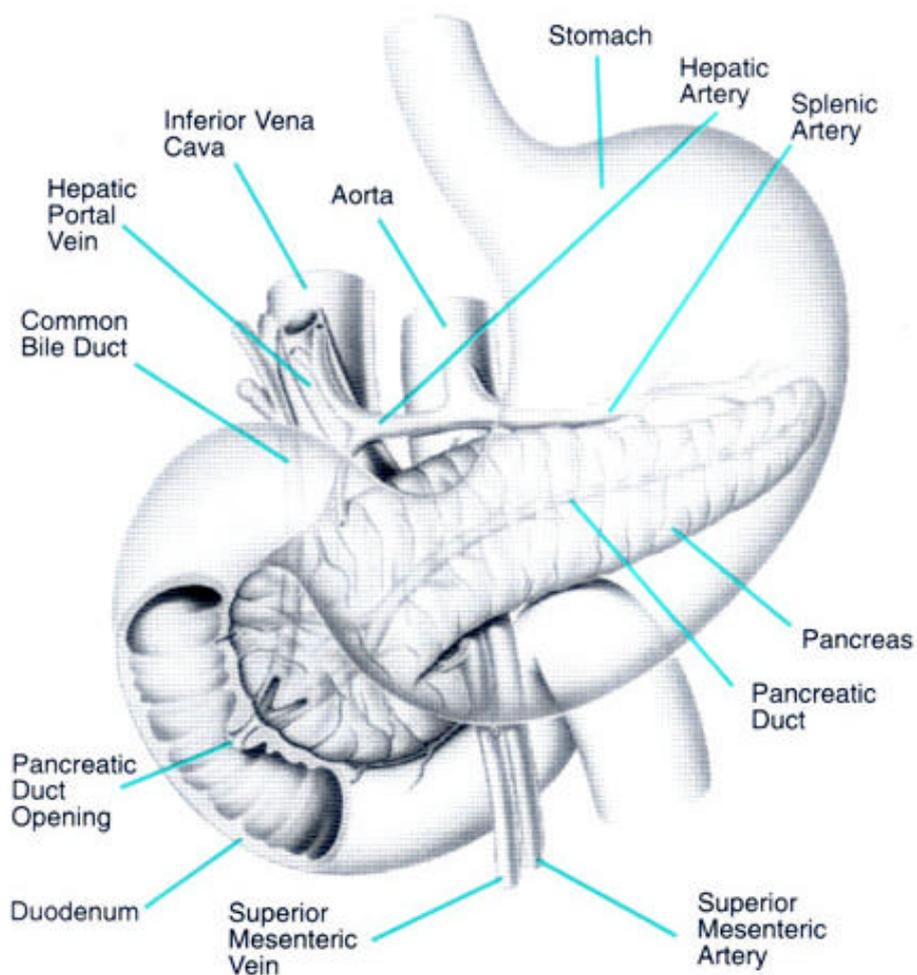
## WHAT IS THE PANCREAS?

The pancreas is a solid gland measuring 20-25cm in length, 4-6cm in width and 3-4cm in depth. It is firmly attached in the back of the abdominal cavity behind the stomach. The pancreas is divided into 5 parts - the head, the uncinuate process, the neck, the body and the tail. The head of the gland is closely attached to the **duodenum** which is the first part of the small intestine into which the stomach empties liquids and partially digested food. The head of the gland is situated just to the right of the midline of the abdomen and below the right rib-cage.



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The uncinata process is an extension of the lower part of the head of the gland which surrounds important blood vessels. The body and tail of the pancreas lie at an angle so that the tail of the pancreas is situated beneath the extreme edge of the left rib cage. The tail of the gland is closely attached to the central part of the spleen with which it shares a common blood supply. Running behind the neck and uncinata process are many important blood vessels which supply the liver, the rest of the gut organs and the kidneys, including the aorta (an artery) which takes all the blood to the lower abdomen and legs, and the inferior vena cava (a vein) which returns blood from these areas. The **splenic vein** runs immediately under



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the tail and body of the pancreas and joins with the **hepatic portal vein** that runs immediately under the neck of the pancreas.

Running along the length of the pancreas within its centre is the **main pancreatic duct**, which empties pancreatic juice into the duodenum. Also running through the middle of the head of the pancreas is the **main bile duct** which also empties into the duodenum. (The main bile duct carries bile from the liver where it is made and also from the **gallbladder** where it is stored). In most people the pancreatic duct and bile duct join together just before they open into the duodenum through a large fleshy nipple called the **ampulla of Vater** (after the person who described this).

Surrounding the openings of each of these ducts are small muscles that control the release of pancreatic juice and bile and thus act as valves (also called sphincters). There is also a valve that regulates the pancreatic juice and bile together and this sits in the ampulla. This common valve is called the **sphincter of Oddi**, also named after the man who described this.

About one in ten people have two separate pancreatic ducts, one that opens as normal through the ampulla of Vater and the other through a smaller nipple (as called a papilla). For this reason the ampulla of Vater is sometimes called the major papilla and the other smaller opening is called the minor papilla.

Because the pancreatic duct is divided into two separate ducts the condition is called **pancreas divisum** (the Latin term for divided is divisum). The pancreatic duct that opens through the minor papilla is called the **accessory pancreatic duct** (normally this joins the main pancreatic duct rather than opening separately into the duodenum).

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## WHAT DOES THE PANCREAS DO?

The pancreas does two important things:

- It makes enzymes which are necessary to digest food in the intestines.
- It produces insulin to enable every part of the body to use glucose (sugar).

### 1. DIGESTION

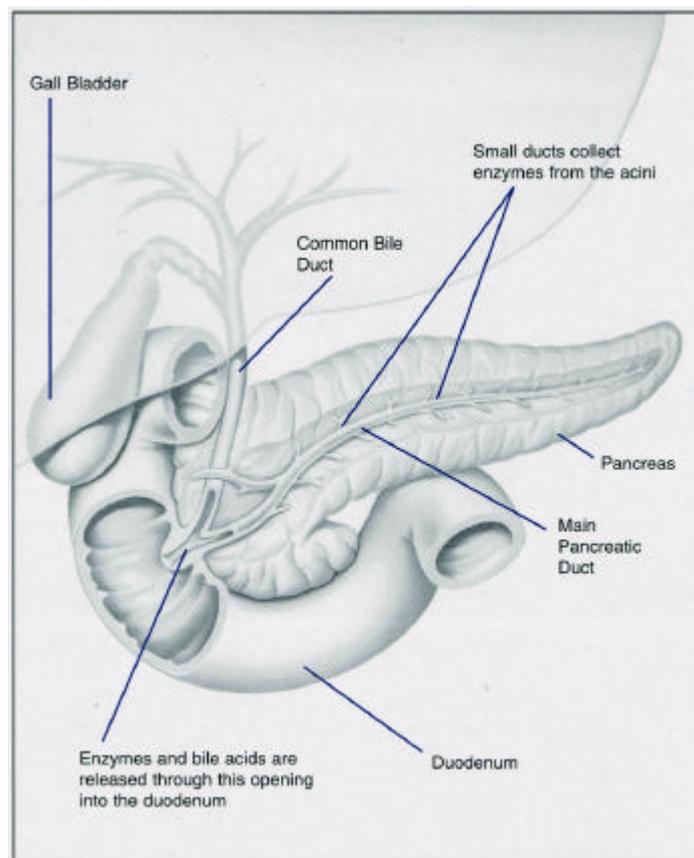
Food is partly broken down by the acid and churning action of the stomach. After 1-2 hours food is slowly released into the duodenum through a valve called the pylorus. Here, and as it moves along the rest of the small bowel, the food is broken down into tiny particles. Nutrients are absorbed by the small intestine and used for energy and maintaining strong muscles and bones. Unwanted material passes into the large bowel (colon) and after 24 hours or so is excreted as stool via the rectum and anus.

Digestion of food which consists of carbohydrates (e.g. glucose), proteins (e.g. meat) and fat (e.g. butter) is not possible without the pancreas. Groups of glands in the pancreas (called acini) make 30 or so different **enzymes** each of which is responsible for breaking down clumps of different types of food into small particles for absorption. These enzymes are collected from the small glands in the pancreas into small ducts and finally into the main pancreatic duct to be released into the duodenum.

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The enzymes when they are first made in the acini are not active (otherwise they would digest the pancreas as well!). When they pass into the duodenum however, they are made active by the juice of the duodenum. The main enzymes are called amylase for digesting carbohydrates, trypsin for digesting proteins and lipase for digesting fats.

Digestion is also assisted by enzymes made and released by the salivary glands (amylase), tongue (lipase), stomach (pepsin and lipase) and small intestine (peptidases).



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**The digestion of fat is very special.** Fat needs to be dispersed before the pancreatic enzymes can properly break it down. This dispersion of fats is made by bile acids, which are present in bile produced by the liver and stored in the gall bladder. **Bile acids** act in exactly the same way as detergents, which are used to wash up greasy dishes. Therefore, both bile acids and pancreatic enzymes are needed for fat digestion. This is why the main pancreatic duct and the main bile duct join up together so that pancreatic juice and bile can be emptied together. If there are not enough pancreatic enzymes, fat is not digested and the stools (bowel motions) become pale and greasy. These greasy stools may become difficult to flush away from the toilet and may give off a strong offensive smell. Doctors call this **steatorrhoea**, which is a way of saying fatty stool.

For the same reason if the main bile duct becomes blocked, then the bile cannot get into the duodenum. This means that the fat cannot be properly digested and results in the stools becoming pale in colour. Because the bile made by the liver cannot go into the bowel it goes into the blood and out through the kidneys into the urine. This results in the eyes and skin becoming yellow and is known as yellow jaundice. As the bile is in the urine this now becomes dark in colour. Because the flow of bile is blocked (or obstructed), doctors call this condition **obstructive jaundice**. As the bile duct goes through the head of the pancreas yellow jaundice can be caused by disease of the pancreas (such as pancreatitis or cancer).

## **2. INSULIN AND GLUCOSE METABOLISM:**

All the cells of the body use glucose as a source of energy in order to maintain their different functions (e.g. electrical activity of the brain and

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contraction of the heart and muscles). Sugar comes directly from digestion or is made in the liver from concentrated forms of sugar (glycogen). The level of sugar in the blood is kept constant by special control mechanisms involving hormones. There are many different types of hormones each with a specific task. Hormones act as messengers and work like a key opening the lock of a door.

Hormones are made in different places, are then secreted into the blood and will work on cells at many different sites. **Insulin is a hormone** which unlocks a special 'door' in the cells of the body to allow glucose to pass in to the cells. If insulin is lacking, then sugar diabetes develops (doctors call this diabetes mellitus). Instead of entering the cells of the body, the sugar stays in the blood which is very harmful at high concentrations. Insulin is made in special groups of cells called **islets of Langerhans** which are dispersed throughout the pancreatic gland.



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A large proportion of the islets (pronounced 'eye-lets') are in the tail of the gland.

Most of the pancreas can be removed but there are usually enough islets remaining to make insulin sufficient to prevent sugar diabetes from occurring.

As you are probably aware, diabetes can be treated by taking regular injections of insulin, which can be taken from the pancreas of animals (e.g. pork insulin) or made by genetic engineering (so called 'human' insulin).

Enzyme production and insulin production are independent. Because digestive enzymes and insulin are made by different parts of the pancreas, a problem with enzyme production does not mean necessarily that there will be a problem with insulin production.

Similarly, if there is a problem with insulin production, this does not mean necessarily that there will be a problem with enzyme production.

Assuming that the pancreas was normal to begin with, increasing loss of the pancreas gland (by disease or surgery) usually results in more loss of enzyme production before there is obvious loss of insulin production. Another way of saying this, is that the insulin 'reserve' is much more than the enzyme 'reserve' of the pancreas.

## **SPECIAL**

### **INVESTIGATIONS FOR PROBLEMS**

#### **WITH THE PANCREAS**

Your doctor **may** need to do some tests to find out more about your particular problem. Perhaps you've already undergone one or more of them. The next section describes what these tests are, how and why they are done, and how they can help your doctor to treat your problem.

#### **ULTRASONOGRAPHY**

##### **OR ULTRASOUND (US) SCAN:**

This is a simple, painless and relatively quick investigation which can be used to obtain a 'picture' of the inside of the abdomen. The only preparation needed is for you to avoid eating for 6-8 hours prior to the test, as any fluid or food which is taken by mouth can obscure the pictures produced. Pictures are made using harmless sound waves. These waves bounce off interfaces between dense and less dense structures. The sound waves will not cross solid areas (such as bone) or areas containing air or other gas. Usually only a fairly simple picture of the pancreas, liver, bile ducts and gallbladder can be obtained.

The test is performed while you lie fully awake on a simple couch. A special jelly, a bit like vaseline is used to enable the 'probe', which produces and collects the sound waves, to be moved over the skin of the abdomen. The radiologist (or an assistant called a radiographer) moves the probe around and looks at a TV screen while this is done to see what pictures are being made. Although sound waves are generated during the procedure these cannot be heard.

#### **COMPUTERISED TOMOGRAPHY (CT SCAN)**

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This is more complex and time consuming than an ultrasound scan but produces excellent pictures of the pancreas and other abdominal structures. As with ultrasound you need to avoid eating for 6-8 hours beforehand and is performed while you are fully awake.

You lie on a special couch attached to the CT scanner which looks like a large 'doughnut'. A CT scan uses X-rays which are emitted and collected through 360°. The couch is made to move through the doughnut as the X-rays are then put together by a computer to produce the pictures at different levels of the abdomen. In order to make it easier to interpret the structures in the abdomen, you will be asked to swallow a liquid (or 'contrast'). This fills the stomach and the intestines. Another injection of a different contrast ('dye') is given into a vein (usually in the arm) during the second half of the procedure. This helps to show up the blood vessels.



**FINE NEEDLE ASPIRATION (FNA)**

**BIOPSY OR CYTOLOGY**

**USING ULTRASOUND OR CT SCAN**

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A small piece of tissue from the pancreas may need to be taken to help make a diagnosis. There are many ways that this can be done especially using an ultrasound scan or a CT scan to tell the doctor where to pass the needle. These procedures are always done in the X-ray department and require additional informed, written consent.

The procedure is done using sterile procedures, so the skin is cleaned with an antiseptic and special gowns are used. Local anaesthetic is injected into the skin. A very fine needle is then introduced and its tip positioned using pictures from the scan before any tissue is taken.

If solid tissue is taken, however small this is called a biopsy and is examined by a pathologist using a microscope (called **histology**). Because a fine needle is used it is called a **fine needle biopsy**.

If only some individual cells have been removed these are also examined by a special pathologist called a **cytologist** and the examination is called **cytology**. Because the cells are obtained by a sucking action (or aspiration) on the needle using a syringe, the procedure is called **fine needle aspiration (FNA) for cytology or just FNA**.

### **Are needle biopsy and aspiration cytology safe?:**

These procedures are safe and accurate in specialist centres. Complications such as bleeding or acute pancreatitis can occur, but only very occasionally.

## **ENDOLUMINAL ULTRASOUND (EUS)**

This is a special investigation for taking ultrasound pictures of the pancreas, pancreatic and bile ducts and surrounding tissue such as blood vessels. The pictures are taken by a special probe inserted into the stomach and duodenum.

Because the ultrasound probe is much closer to the pancreas, EUS can provide pictures that are much clearer than the usual ultrasound scan. The pictures that it provides are complementary to those given by ultrasound or CT.

EUS is performed using special flexible telescope with an ultrasound probe at its tip. The telescope (or endoscope – hence *endoscopic* ultrasound) is passed into the mouth, down the gullet and into the stomach. At this point the ultrasound probe is switched on and the pancreas can be seen through the stomach wall.

The pictures are displayed on a television screen and copies of the images can be made. The telescope is then passed into the duodenum to obtain different views of the pancreas and also of the bile ducts, gallbladder and the liver.

If your doctor decides you should have an EUS it is essential that you do not eat or drink anything for at least 8 hours before the test. The procedure is done on a flat couch under sedation. You will be asked to sign a consent form agreeing to this procedure because it is complicated. Normally you are taken on a trolley to the endoscopy or X-ray department and, after being checked by a nurse, asked to move onto the flat couch. You will be asked to lie on your left side with your left arm behind your back and be given a throat spray of local anaesthetic. This

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tastes awful but the feeling quickly goes and it will stop any coughing during the procedure. At this stage you are given a strong sedative by injection.

This is enough to make most patients very sleepy but not fully unconscious. It is very important that you are as relaxed as possible before and during the procedure. The telescope is easily passed into the mouth and stomach. There is then a strange sensation as air is introduced into the stomach. Belching should be avoided as the air helps the endoscopist to pass the tip of the telescope into the duodenum. Most patients usually do not remember anything of the procedure.

EUS may be used to remove small cells using a small needle inserted into an area that your doctor believes to be important. Cells are drawn up a small tube (or cannula) using a small syringe. This procedure is therefore called **EUS aspiration cytology (or EUS FNA)**.

The results may be explained to you or a relative on the ward but the best time to discuss the findings is at the next out-patient visit or the next day on the ward. The results of cytology are often not easy to interpret and may take a while for them to become available. Sometimes this may take up to two weeks.

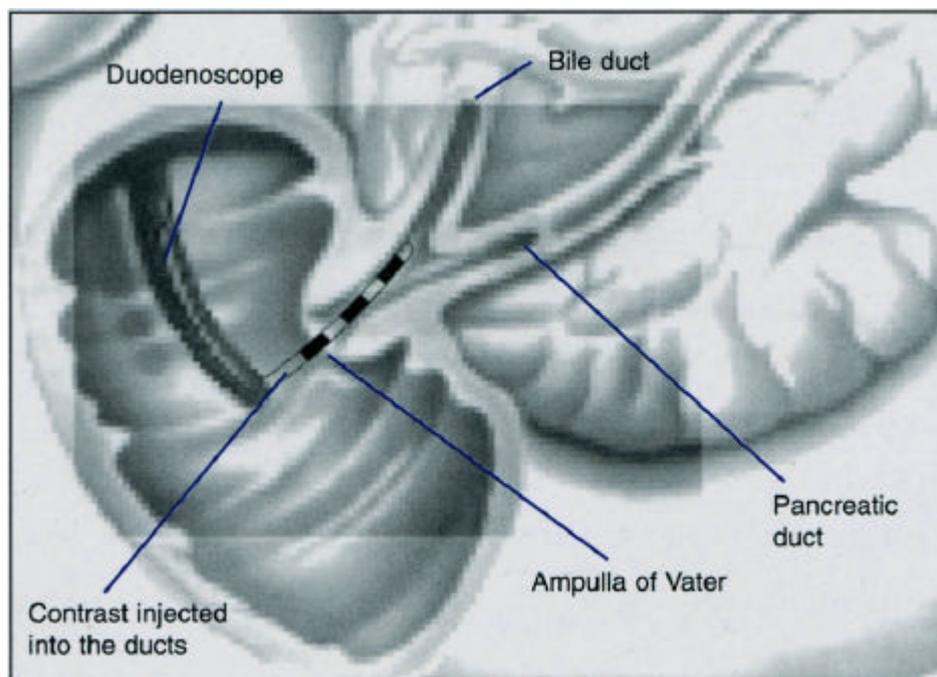
If you are an out-patient, full details will also be sent to your GP. The results are usually combined with other tests to provide an overall diagnosis. It is always necessary for a friend or relative to drive you home if you have had an EUS as an out-patient because it takes several hours for the effects of the drugs to wear off.

**ERCP**

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This is a special investigation for taking pictures of the bile and pancreatic ducts and is mainly used for **treatment of bile duct and pancreatic duct problems**. The full name of ERCP is rather a mouthful: endoscopic retrograde cholangio-pancreatography! As with EUS it involves inserting a flexible telescope or endoscope (also called a duodenoscope) into the mouth. This is passed down the gullet and into the stomach and then into the duodenum opposite the opening of the bile duct and pancreatic duct.

A small tube (**cannula**) is then pushed into the opening (ampulla of Vater) and contrast ('dye') is injected into the ducts. You lie on an X-ray table to enable pictures of the ducts to be taken while the contrast is injected. If your doctor decides you should have an ERCP it is essential that you do not eat or drink anything for at least 8 hours before the test.



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Usually a plastic tube is put into a vein of the right forearm or the back of the hand before you go to the X-ray department. You may need a drip of intravenous fluids and be given one or more antibiotics in the drip.

You will be asked to sign a consent form agreeing to this procedure because it is complicated. Normally you are taken on a trolley to the X-ray department and, after being checked by a nurse, asked to move onto the X-ray table. As with EUS, you will be asked to lie on your left side with your left arm behind your back and be given a throat spray of local anaesthetic. This tastes awful but the feeling quickly goes and it will stop any coughing during the procedure. A second spray may then be given under the tongue, which contains a substance to help the ampulla of Vater open up during the procedure. A strong sedative is now given by injection.

This is enough to make most patients very sleepy but not fully unconscious. As with EUS, it is very important that you are as relaxed as possible before and during the procedure. The telescope is easily passed into the mouth and stomach. There is then a strange sensation as air is introduced into the stomach. Belching should be avoided as the air helps the endoscopist to pass the tip of the telescope into the duodenum. Most patients usually do not remember anything of the procedure.

To treat bile duct or pancreatic problems by this means, it is common to cut the sphincter of Oddi (see above) using a small electric current on the tip of the cannula (see above). This procedure cutting the sphincter is called a sphincterotomy. Because it is performed using an endoscope its full name is **endoscopic sphincterotomy**. By cutting the sphincter it

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makes it easier to insert bigger instruments into the bile duct or pancreatic duct to remove any gallstones or pancreatic stones.

Sometimes it is necessary to insert a temporary (plastic) or permanent (metal mesh) tube into the bile duct to keep a good flow of bile. These tubes are called **biliary stents** – after Dr Stent who first used these small tubes. Stents or temporary tubes (also called a cannula) may also be inserted into the main pancreatic duct.

A **plastic stent** is often a temporary measure to relieve jaundice and may precede surgery.

A **metal stent** (in the form of a wire mesh) is usually a permanent measure. It does not preclude major surgery but the operation is more challenging for the surgeon.

A small piece of tissue can be removed using minute tweezers (called forceps). This small piece of tissue is called a biopsy and is checked by histology. This procedure is therefore called **endoscopic biopsy**.

A small brush may also be used to brush the side walls of the bile duct or pancreatic duct to obtain small cells that can be checked by cytology. This procedure is therefore called **brush cytology**.

The results may be explained to you or a relative on the ward but it can take time to receive the results of histology or biopsy. If you have been treated mainly as an out-patient, then the best time to discuss the findings and any procedures is at the next out-patient visit or the next day on the ward.

If you are an out-patient, full details will also be sent to your GP. The results are not always easy to interpret and are usually combined with other tests to provide an overall diagnosis.

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It is always necessary for a friend or relative to drive you home if you have had an ERCP as an out-patient because it takes several hours for the effects of the drugs to wear off.

## **Is ERCP safe?:**

ERCP is safe with no complications in about 95% of cases. There are occasionally complications from ERCP however, the most common of which are abdominal pain, acute pancreatitis, biliary infection and bleeding.

If the procedure was planned as a day case procedure, it will be necessary to keep you in hospital overnight if there has been a complication.

In most cases, the complications improve, and patients are soon discharged. Very occasionally the complication is serious and death may result in a very small proportion of cases. For patients that are having ERCP for treatment (such as having a stent inserted or removed) special precautions are taken to reduce the risk. These precautions usually include having a drip running in extra fluid into an arm or neck vein, antibiotics and a bladder tube (urinary catheter) and a urinary collecting bag to make sure that the kidneys (which make the urine) are working properly.

For these reasons, an ERCP must be:

- **Performed by a specialist.**
- **Performed for a good reason.**

## **MAGNETIC RESONANCE IMAGING (MRI)**

An **MRI scan** is similar to a CT scan but uses magnetic resonance to image the pancreas instead of X-rays. Very powerful magnets are used to

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generate the pictures. For this reason patients that have certain metal parts inside their bodies (that can respond to the magnet) must not have this procedure. Most modern appliances introduced into patients, such as clips during open surgery or a heart valve with metal parts, are made of material which cannot respond to the magnet and are therefore safe. As a precaution you must tell your doctors if you have any such appliances in your body to let them decide.

MRI scans have the advantage that no X-rays are emitted and therefore are particularly suited to patients who need to have many such tests. The type of pictures produced by MRI however are not the same as CT and the decision of which to use and when to use them will rest with your doctors.

MRI can also be used to provide very good pictures of the bile ducts and pancreatic ducts. This procedure is called **MRCP**, which is short for magnetic resonance cholangio-pancreatography.

### **PTHC**

Sometimes it is not possible to approach the bile duct or to enter the bile duct using ERCP. In this situation it may be necessary to insert a very fine needle into the bile duct by going first through the skin on the right side and then finding a branch of the main bile duct in the liver. Therefore the full name of this procedure is percutaneous transhepatic cholangiography and is always performed in the X-ray department.

Pictures of the bile ducts are taken after injecting some 'dye' or contrast. PTHC can be used to provide temporary drainage of bile, remove gallstones from the bile duct, perform brush cytology (see above) and insert a biliary stent (see above), which may be either plastic or metal.

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PTHC is usually done using an ultrasound scan or a CT scan to tell the doctor where to pass the needle. The procedure is done using sterile procedures, so the skin is cleaned with an antiseptic and special gowns are used. Before the needle is passed local anaesthetic is injected into the skin. The needle may need to be passed between the lower ribs on the right hand side but this is quite safe.

In difficult situations both PTHC and ERCP are performed together - one technique makes it easier for the other technique to be successful. When both techniques are used together it is known as a **combined procedure** or **rendezvous procedure**. PTHC requires additional informed, written consent.

## Is PTHC safe?:

PTHC is safe with no complications in about 95% of cases. There are occasionally complications from PTHC however, the most common of which are abdominal pain, biliary infection, bleeding and a bile collection or abscess. In most cases, the complications improve. Occasionally the complication is serious and death may result in a very small proportion of cases.

Special precautions are taken before the procedure is performed to reduce the risk. These precautions usually include having drip running in extra fluid into an arm or neck vein, antibiotics and a bladder tube (urinary catheter) and urinary collecting bag to make sure that the kidneys (which make the urine) are working properly.

This procedure is only performed if it is really necessary and is only performed in specialist centres.

## PET Scan

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This is a special scan performed in the Nuclear Medicine Department and is sometimes performed in certain centres if there is uncertainty as to the diagnosis. In other words this is performed if the doctors are not sure if you have chronic pancreatitis or a small pancreatic cancer. It is also used in some centres to see if the pancreas cancer has spread to other organs. It is also used to see how well some new treatments work in cases in which the cancer cannot be removed by surgery.

The full term for a PET scan is Positron Emission Tomography. Patients are fasted for 6 hours before going to the Nuclear Medicine Department. You are asked to lie down on a special couch underneath a special camera called a gamma camera. Fifteen minutes or so after the intravenous injection of a special chemical the camera will take images of your pancreas. The chemical contains a small amount of relatively harmless radioactivity. The PET scan is performed in the Nuclear Medicine Department which has special facilities to contain the radioactivity. The results will be explained to you by your doctors once they have put together the information from the PET scan as well as other tests such as results from the CT scan.

### **CANCER OF THE PANCREAS**

#### **WHAT IS CANCER?**

Cancer can arise in any part of the body when particular cells begin to multiply more than normally and spread into other tissues. Cancer arises because of defects within the genes of cancer cells, although the reason for these defects arising in the first place is not known in most cases.

If left untreated, cancers cause harmful effects by invading vital tissues. Cancers sometimes produce harmful substances which can lead to poor appetite and weight loss.

## HOW IS CANCER TREATED?

Many cancers can be cured by surgery which is called **'curative surgery'**. In some cases, even though the cancer cannot be removed or can be removed only partly, surgery is still very helpful in relieving symptoms, in which case it is called **'palliative surgery'**.

Even if a patient has had 'curative surgery' the cancer cells may have already spread in blood vessels to other organs but cannot be seen or felt or diagnosed by investigations. Because of this it is often necessary to recommend additional treatment after curative surgery in the form of **chemotherapy** (giving drugs which kill cancer cells). This type of additional treatment is called **'adjuvant therapy'** and helps to increase the chances of being cured properly.

If the cancer cannot be removed by surgery it is often useful to give chemotherapy, radiotherapy or a combination of these to slow down the growth of the cancer. This type of treatment is known as **'palliative therapy'**.

There have been big advances in the use of chemotherapy and radiotherapy so that many of the serious side-effects that used to be seen with these treatments (such as loss of hair) do not occur frequently.

The use of chemotherapy and radiotherapy for many cancers is being improved all the time by asking patients to participate in **'clinical trials'**. This means that the doctor treating the patient is not sure which type of treatment is best and so will allocate one or other treatment with the patient's permission.

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Inevitably some patients will die from cancer. It is important from the outset that the patient and relatives are both aware of what the situation is and are encouraged to talk freely about this between themselves and with friends. Most patients will be able to lead a normal life right up to the last few days or weeks. Pain and vomiting are a feature of some cancers but there are now very effective drugs to deal with both. No patient should suffer from unbearable pain.

There are now very good cancer services around the country. Macmillan Nurses are specially trained to deal with patients with cancer, who can visit the patient at home on a regular basis. Hospices are specialised hospitals dealing with the needs of patients with advanced cancer. Patients may be attached to a hospice as an outpatient as well as being an inpatient. The most important doctor co-ordinating cancer care will be the General Practitioner. Many patients choose to spend their last days at home and health support services usually will be provided to make this possible. In some cases, depending on the home circumstances and the patient's particular problem, this is not possible so the hospice or even the hospital may be the best place.

It is always important to be open about the problem. Doctors involved with patients and their relatives will always be keen to discuss the issues and answer all their questions.

Remember that even if it is not possible to guarantee a cure, treatment can prolong life and give patients an excellent quality of life. Also, remember that cancer can be cured!

### **WHAT IS CANCER OF THE PANCREAS?**

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The cause of pancreatic cancer is largely not known, although in the case of ductal-type cancer (see below) there is an association with **smoking** tobacco. There is also an increased risk in patients with **chronic pancreatitis** and **Hereditary Pancreatitis**. Pancreatic cancer also occurs in certain familial cancer syndromes such as **Peutz-Jeghers Syndrome**, **Breast and Ovarian cancer Syndromes**, **Familial Atypical Mole and Melanoma Syndrome** and **Familial Adenomatous Polyposis**. Rarely there are families with **Familial Pancreatic Cancer**.

Most commonly cancers of the pancreas arise in the head of the gland. This has two effects. First, the cancer blocks the bile duct leading to jaundice, dark urine and pale stools. There is sometimes itching of the skin due to jaundice, which rapidly disappears once the blockage is cleared or bypassed. Second, the cancer blocks the pancreatic duct leading to poor digestion, loose motions and weight loss. This can be relieved by clearing the blockage or by giving pancreatic enzyme tablets. Diabetes may already be present in a number of patients prior to developing the cancer or become apparent soon after it is diagnosed or following surgery.

There are many types of cancer of the pancreas.

### **Common Pancreatic Cancer**

The commonest type of pancreatic cancer is that arising from the small ducts of the pancreas (**ductal-type adenocarcinoma**). Most often it arises in the head of the gland and a principle feature is the development of obstructive jaundice (**see above**). This type of cancer often occurs in individuals aged 60 years or older but it can affect younger people as well. **Resection of the cancer followed by adjuvant chemotherapy** is the standard treatment. If this is not possible it may be possible to obtain

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good palliative results with chemotherapy. Patients are strongly advised to join a clinical trial, which will normally always be available at their regional centre.

## **Typical early symptoms are:**

- jaundice,
- dark urine,
- pale stools,
- itching,
- feeling of sickness (nausea),
- slight weight loss
- unexpected development of diabetes (in someone over 50 years old who is not obese).

**Tumours in the body and tail of pancreas.** These tumours are more difficult to pick up early because they do not cause obstructive jaundice.

## **Typical symptoms for body and tail of pancreas tumours are:**

- vague abdominal pain,
- dyspepsia,
- stomach ulcer-like pain,
- intermittent diarrhoea,
- feeling of sickness (nausea),
- weight loss,

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- unexpected development of diabetes (in someone over 50 years old who is not obese),
- back pain that does not go away,
- unexplained blood clots (venous thrombosis).

Remember that an abdominal US scan is likely to miss an early pancreas cancer. Therefore you must insist on a pancreas specific CT scan – this is fast (takes only a few minutes), highly accurate and not so expensive compared to the US scan.

### Tumours of the Ampulla of Vater

Tumours may arise from the ampulla of Vater. They also cause obstructive jaundice (see above) and they tend to affect older patients. The **best treatment is resection**. The role of adjuvant chemotherapy is uncertain and therefore you should join a clinical trial if possible. The success rate of treatment of these ‘ampullary’ tumours is much, much better than the results of treatment of common pancreatic cancer.

### Intra-pancreatic Bile Duct Cancer

A cancer may arise in the bile duct as it travels through the pancreas. They also cause obstructive jaundice (see above) and are usually confused with the common pancreatic cancer. In fact the only way of knowing this is for the pathologist to examine the resected specimen under the microscope. The **best treatment is resection**. The role of adjuvant chemotherapy is uncertain and therefore you should join a clinical trial if possible. The success rate of treatment of these bile duct cancers is much better than the results of treatment of common pancreatic cancer.

## Duodenal Cancer

Tumours may arise from the duodenum and may cause anaemia, bleeding or vomiting but sometimes they also cause obstructive jaundice (see above). The **best treatment is resection**. The role of adjuvant chemotherapy is uncertain and therefore you should join a clinical trial if possible. The success rate of treatment of these duodenal tumours is much better than the results of treatment of common pancreatic cancer.

## IPMT (Intraductal Pancreatic Mucinous Tumour)

These are cancers that arise from **lining of the main pancreatic duct**. These tumours secrete a large amount of mucous (much more than usual) and so the pancreatic duct dilates. The tumours may be **benign or malignant**. The tumours may occur in only a small part of the main pancreatic duct or affect the whole length of the pancreatic duct. Small swellings may develop from the sides of the main pancreatic duct full of mucous to give the appearance of cysts. If the mucous enters the bile duct then this will cause obstructive jaundice (see above). Usually the **best treatment of IPMTs is resection**. The success rate of treatment of IPMTs is much, much better than the results of treatment of common pancreatic cancer.

## Cystic Tumours

Tumours in the pancreas can develop as cysts. The tumours may be **benign or malignant**. In non-specialist centres they may be confused with pancreatic pseudocysts (pronounced 'Sue-doe-cyst') that occur because of inflammation of the pancreas called pancreatitis.

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The content of the cyst can be rather watery and this type of cystic tumour is called **serous cystadenoma**. This type of tumour is **benign, meaning non-malignant and non-cancerous**.

The content of the cyst can be filled with mucin and this type of cystic tumour is called a **mucinous cystadenocarcinoma**. This type of tumour is **malignant, meaning cancerous**. If the cyst presses on the bile duct then this will cause obstructive jaundice ([see above](#)). The **best treatment is resection**. The success rate depends on whether all of the cancer can be properly removed.

### **Neuroendocrine Tumours (PNETs)**

These are also called PNETs, short for pancreatic neuroendocrine tumours. These tumours may arise from the endocrine cells in the islets of Langerhans in the pancreas (**islet cell tumours**) or so called neuroendocrine cells either in the pancreas or ampulla of Vater (**carcinoid tumours**) or the duodenum (**gastrinomas**). The success rate of treatment of these PNETs is much better than the results of treatment of other types of pancreatic cancer.

PNETs can secrete one of six or more different hormones causing different types of illness (or syndrome) and are called **functioning neuroendocrine tumours**. Also neuroendocrine tumours may not secrete any hormones and are then called **non-functioning neuroendocrine tumours**. Endocrine tumours can affect individuals at any age and they can even arise in small babies.

Tumours that release excess insulin are called **insulinoma**. These tumours are nearly always **benign, meaning non-malignant and non-cancerous**. Tumours that release excess gastrin are called **gastrinoma**

and occur in the pancreas and in the duodenum. These tumours are mostly **malignant, meaning cancerous**. Other types of functioning neuroendocrine tumours are called glucagonomas, VIPomas, somatostatinomas and PPomas and are usually malignant, meaning cancerous. PNETs may be inherited and the two main types of hereditary pancreatic neuroendocrine tumours are found in multiple endocrine neoplasia type 1 (MEN-1) and von Hippel-Lindau disease (VHL), but also in the rarer disorders of neurofibromatosis type 1 and tuberous sclerosis.

## **TREATMENT OF PANCREATIC CANCER**

### **CURATIVE TREATMENT**

#### **Pancreatic Cancer Resection**

The best treatment for pancreatic cancer is **surgery to remove the cancer (resection)** but this can be quite difficult and is not always very successful. The best results are achieved in **regional pancreas cancer centres** that cover populations of at least two million people. So it is important that you are referred by your doctor or local hospital to your nearest regional centre.

#### **Adjuvant Chemotherapy**

It is **now standard treatment to give chemotherapy** if you have the common ductal type pancreas cancer once you recover from the resection surgery. This is called adjuvant chemotherapy. This will only be started once you have fully recovered from your operation and have gotten over any post-operative complications. Usually six treatments (or cycles) are given by a local **medical oncologist** (cancer doctor). This period of

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treatment usually last six months. The medical oncologist will answer all your questions. In particular it is important to appreciate that modern chemotherapy is usually not associated with major side effects (such as hair loss). Because we are not sure which adjuvant chemotherapy is the best you **may be asked to participate in an approved clinical trial.**

Immediately after your surgery you will feel quite weak and wonder whether you will ever get back to normal strength. In fact you will get back to normal, although this may take 6-12 months. We know that even if you are feeling 'rough' you can still have the adjuvant chemotherapy and it will not interfere with your rate of recovery.

**We use adjuvant chemotherapy because it prolongs survival.**

## **PALLIATIVE TREATMENT**

If resection of the cancer is not possible there are many treatments that will be given to help you.

### **Biliary Stenting**

Older patients may not be suitable for surgery. The jaundice can still be relieved by inserting a tube (stent) through the tumour during ERCP (biliary stent, [see above](#)). If it is not possible to do this by ERCP, then an alternative is by PTHC or a combination of ERCP and PTHC and is called a **combined procedure** or **rendezvous procedure** ([see above](#)).

### **Endoscopic Duodenal Stenting**

Obstruction to the duodenum usually needs surgery. An alternative in older patients is to insert a tube through the duodenum. In the X-ray department a flexible telescope or endoscope is passed into the mouth. This is then eased down the gullet and into the stomach and then into the

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duodenum. A small guidewire is then pushed through the tumour. The special tube or stent is then pushed over the guidewire and through the tumour. You lie on an X-ray table to enable pictures of the procedure to be taken as it is being performed. It is essential that you do not eat or drink anything for at least 8 hours before the procedure is performed.

Usually a plastic tube is put into a vein of the right forearm or the back of the hand before you go to the X-ray department. You may need a drip of intravenous fluids. You will be asked to sign a consent form agreeing to this procedure because it is complicated. Normally you are taken on a trolley to the X-ray department and, after being checked by a nurse, asked to move onto the X-ray table. You will be asked to lie on your left side with your left arm behind your back and be given a throat spray of local anaesthetic. This tastes awful but the feeling quickly goes and it will stop any coughing during the procedure. A strong sedative is now given by injection.

This is enough to make most patients very sleepy but not fully unconscious. It is very important that you are as relaxed as possible before and during the procedure. The telescope is easily passed into the mouth and stomach. There is then a strange sensation as air is introduced into the stomach. Belching should be avoided as the air helps the endoscopist to pass the tip of the telescope into the duodenum. Most patients usually do not remember anything of the procedure.

The special tube or stent is permanent and is a metal mesh. This gradually expands over a few days after it has been inserted, so the relief from nausea may not be immediate.

### **Chemotherapy**

This is also advised for patients with a cancer that cannot be removed as this **makes you feel better** (doctors say ‘improves symptoms’) as well as **increasing the length of time that you have to live**. Because doctors have still to work out the best type of chemotherapy there are many clinical trials that compare the best available treatment with a new treatment. We have a trial because we do not know if the new treatment is actually better. Patients usually benefit by being in a trial so **patients are recommended to consider joining an approved trial**.

## Special Treatments For Patients With Pancreatic Neuroendocrine Tumours

The symptoms of some patients with certain types of pancreatic neuroendocrine tumour can be greatly relieved by special drugs (such as **octreotide**). The exception is insulinoma, which should always be treated by surgical removal. Some patients will also benefit from **chemotherapy** and also from a special drug called **interferon–alpha** (mainly for patients with carcinoid tumours). **Special radiotherapy treatment** may be given using chemicals that are tagged with radioactive agents that selectively go to the tumour. This is conditional on the tumour being positive for either the octreotide scan or the MIBG scan ([see below](#)). There are other treatments also available if the tumour has spread to the liver such as **chemo-embolisation** or **radiofrequency ablation**. These are quite new treatments and your doctor will give you more specific information about these if they apply to you.

## OPERATIONS FOR CANCER

Removal of a pancreatic cancer by resection is a major procedure and will only be done by a specialist. Even so the complication rate is 40%. Although these complications can be dealt with, about 5% of patients will

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not be able to leave hospital. Thus the success rate is about 95% but is better in younger, fitter patients. Thus selecting patients for resection is very important and requires several steps.

## Staging of the tumour

In all patients it is important to determine whether an operation is feasible ('staging'). This requires the use of a special CT scan. The specialist may request this investigation even if this has already been performed by the referring hospital. Another 'staging' procedure is to perform **laparoscopy and/or laparoscopic ultrasound**. This is a short operation under general anaesthetic. Using 'key hole' surgery a telescope is inserted into the abdomen to examine the organs. A special ultrasound 'probe' may be used to look at deeper tissues. Some centres may also use a PET scan (see above).

## Are you fit for major surgery?

It is also necessary to ensure that all patients will be fit enough to survive the major surgery. In order to determine this there will be some extra investigations which may include one or more of the following.

An **ECG** (electro-cardio-gram) records the electrical heart activity and may be done on the ward or in the cardiology (meaning heart) department. A **cardiac echo** (doctors say echocardiogram or just echo) uses ultrasound waves to look at how the chambers of the heart are working. An echo is performed either in the cardiology department or the X-ray department. In selected cases you may be asked to undertake some exercise on a treadmill before and after the ECG or the echo.

A **MUGA** scan looks at how well the chambers of the heart work. This test is performed in the Nuclear Medicine Department and you are asked

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to lie on a special couch under a special camera called a gamma camera. It involves giving a small harmless intravenous injection of a radioactive chemical. How well the heart works can now be seen by the gamma camera.

**PFTs** (or pulmonary function tests) look at how well your lungs are functioning. This is usually performed in a special department and involves breathing into a tube attached to a machine.

After these tests you will always be examined by a specialist anaesthetist who will tell you what the risks are of undergoing the surgery. In addition you may be assessed by a heart specialist.

## **MY OPERATION**

Your specialist will give you the details of which procedure is intended before you sign the consent form for operation. The common operations are outlined below.

### **CURATIVE SURGERY**

These operations aim to remove all of the tumour or cancerous tissue.

#### **Kausch-Whipple Operation**

This operation is often just called a 'Whipple's'. It involves removing part of the stomach, the gallbladder and the bile duct, the duodenum and the head of the pancreas.

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#### **Pylorus-Preserving Kausch-Whipple's Operation**

In the procedure, the stomach and pylorus are preserved.

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## **Left Pancreatectomy**

This is also called a 'distal' pancreatectomy. It is performed if the tumour is in the body or tail of the pancreas.

## **Total Pancreatectomy**

In some cases, especially if there is a large cystic tumour or an endocrine tumour the whole pancreas is removed and combines the Whipple and left pancreatectomy procedures.

## **Splenectomy**

In a left or total pancreatectomy the spleen will be removed.

## **Pancreas Preserving Duodenectomy**

In patients with many polyps of the duodenum that are considered a risk of developing into cancer (such as Familial Adenomatous Polyposis, or FAP) it is not necessary to remove the pancreas. In this operation the duodenum is separated from the pancreas and removed. The small bowel is then advanced and joined to the pylorus, the bile duct and pancreatic duct. In effect this creates a 'new duodenum'.

## **PALLIATIVE SURGERY**

This type of surgery is performed if the cancer cannot be removed.

## **Biliary Bypass**

This operation is performed for obstructive jaundice. Obstruction of the bile duct in pancreatic cancer is common. This happens because the cancer in the head of the pancreas can press on the bile duct and cause it to become partly blocked. This causes obstructive jaundice (see above). The narrowing (or stricture) is 'bypassed' using a special small bowel

channel. This operation is called a **Roux-en-Y hepato-jejunostomy** or **Roux-en-Y choledocho-jejunostomy**. Sometimes a very simple bypass is created by joining the bile duct directly onto the duodenum and is called a **choledocho-duodenostomy**. 'Choledodocho' is two words (from Greek and Latin) meaning bile (chole) and duct (docho), whilst 'hepato' refers to the bile duct as it leaves the liver.

## Gastric Bypass

This procedure is undertaken if there is vomiting due to obstruction by a tumour of the duodenum. Obstruction of the duodenum is quite common. This happens because a cancer in the head of the pancreas can press on the duodenum and cause it to become partly blocked. This causes a feeling of sickness (nausea) and vomiting after food. This will obviously contribute to weight loss. The narrowing (or stricture) is 'bypassed' connecting the small bowel to the stomach. This operation is called a **gastro-jejunostomy** or **gastric-bypass**. In fact this may be done during the same time as biliary bypass to avoid the problems of duodenal obstruction at a later date.

## AFTER MY OPERATION

Following the operation it is common practice for you to be cared for on a special ward that has a high ratio of nurses to patients, has provision for expert anaesthetic care and has good monitoring facilities. The type of units and their names may vary from hospital to hospital. Typically you will be cared for in a Post-Operative Critical Care unit or **POCCU** for intensive monitoring for the first 24 hours. Following this you will be transferred to a High Dependency Unit (**HDU**) for several days until your condition has improved sufficiently for you to be returned to the regular **ward**. If there are serious complications you may need to be transferred

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to the Intensive Therapy Unit (ITU) but this is usually not necessary as most complications can be dealt with on the HDU or just the regular ward.

In some hospitals the POCCU facility is placed in the ITU or a special HDU. In these situations you may be routinely observed on the ITU and then HDU, or just the special HDU before going back to the regular ward.

For the first few days you will only be able to drink fluids but the amount will increase from day to day. After six or seven days a light diet will gradually be introduced.

In the absence of any major complications you would expect to be in hospital for two to three weeks.

You will feel quite weak after the surgery. Your strength will gradually improve although this is likely to take 6-12 months before you feel one hundred percent. It may be necessary for you to take some pancreas enzyme tablets to help your digestion during the recovery period (see below). You will feel and look quite normal. Unless you have had a total pancreatectomy you will not become diabetic. You will be able to drink and eat all the foods that you normally would.

### **SPECIAL TESTS AND OPERATIONS FOR PANCREATIC NEUROENDOCRINE TUMOURS**

Patients with pancreatic neuroendocrine tumours need to undergo some special tests that may be extra to those already describe above.

#### **Hormone profile**

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In order to find out whether your tumour is secreting hormones and which hormones are involved you will need to give several blood samples. You may also need to give a sample of urine or urine collected for a complete 24 hour period. If doctors are worried that you have an insulinoma you may need to be fasted for up to 72 hours. The **endocrine team** will help to advise and co-ordinate the collection of samples. The samples are sent to special labs (or laboratories) around the country called reference labs. Because the tests are difficult to perform, the results may take several weeks to be completed. And unfortunately sometimes they have to be repeated.

### Octreotide scan

Most pancreatic neuroendocrine tumours have what are called type-2 receptors (doctors say somatostatin type-2 receptors) on the outer surface of each cell of the tumour. By attaching a radioactive chemical to a particle that attaches to the receptor it is possible to see where the tumour is. This test is performed in the Nuclear Medicine Department and you are asked to lie on a special couch under a special camera called a gamma camera. It involves giving a small harmless intravenous injection of the radioactive chemical. Where and how many tumours there are can now be seen by the gamma camera.

### MIBG scan

Because not all pancreatic neuroendocrine tumours can be seen by the octreotide scan we use another type of scan. MIBG is a special chemical that is taken up by the pancreatic neuroendocrine tumours cells and is concentrated inside the tumour cells. By attaching a radioactive chemical to the MIBG it is possible to see where the tumour is. This test is also performed in the Nuclear Medicine Department. Again you are asked to

lie on a special couch under a special camera called a gamma camera. It involves giving a small harmless intravenous injection of the radioactive MIBG. Where and how many tumours there are can now be seen by the gamma camera.

## Selective arteriography

Despite all the many tests already performed to locate where a pancreatic neuroendocrine tumour is, further tests may still be required. It might be possible to find the tumour because it has a special blood supply. Selective arteriography is performed in the X-ray department. You will then be placed on an X-ray table, the skin cleansed with antiseptic and covered with sterile gowns. Under local anaesthetic a tube will be inserted into the artery in either the left or right groin (called an **arterial catheter**).

‘Dye’ (or contrast) is then injected into the catheter to see where it goes using an X-ray television screen. The catheter can be guided to the different small arteries that supply the pancreas. More ‘dye’ (or contrast) is then injected into each artery and using X-rays the tumour blood supply can be seen on a television screen and pictures are then taken.

## Selective venous sampling

If selective arteriography has not been successful then this sampling technique can be used either in the same or separate sitting. Blood samples are taken from different positions in the veins that drain away from the pancreas. The procedure is also performed in the X-ray department. You will be placed on an X-ray table, the skin cleansed with antiseptic and covered with sterile gowns. Usually using local anaesthetic a wire is pushed through the skin and into one of the branches of the

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hepatic portal vein within the liver. A tube (or catheter) is pushed over the guidewire and the guidewire is removed. The tube is then advanced into the different veins that drain the pancreas and small samples of blood are then taken. The blood samples are then sent for special tests to see if there are any hormones and what the concentration is. Usually there is one area with a very high concentration. This tells the surgeon whereabouts in the pancreas the tumour will be at operation.

## Operations on pancreatic neuroendocrine tumours

The operations performed on PNETs are very similar to those performed on pancreatic cancers in general (see above). The choice of operation depends on the number and position of the tumours. In the case of insulinoma, usually only a very small procedure needs to be done on the pancreas. This simply involves removing the tumour only but not removing any of the pancreas. This operation is called **enucleation**. This is still classed as a major operation however as a big abdominal incision is still needed and major surgery is needed to find the pancreas. Also you will still need to be monitored closely after surgery to check on the blood sugar levels.

## CONTROL OF PAIN

There may be severe pain from pancreatic cancer if the cancer cannot be removed. You will be seen by a specialist **pain team**, which will help to find the best combination of medication for you. This frequently involves the use of **morphine tablets** of one kind or another. These kinds of tablet cause two particular problems. One is a feeling of sickness (called nausea), so you will need to take **anti-sickness tablets**. The other problem is constipation so you will need to take some form of **stool loosening medicine or laxatives**. Most patients manage very well on this

type of medication but sometimes it is necessary to resort to special pain killing measures. This involves paralysing or cutting the pain nerves that go between the brain (where the pain is felt) and the pancreas.

## *Coeliac plexus nerve block*

The nerves from the pancreas collect just behind the pancreas in a thick bundle called the coeliac plexus (coeliac is pronounced 'see-lee-ack'). These nerves can be injected using a long needle and local anaesthetic in the X-ray department or using a needle with the endoscope during EUS (see above). If a local anaesthetic is used this may reduce the pain, but usually this only lasts for a few weeks. It is also possible to block the nerves permanently using special chemicals (called sclerosants) such as concentrated alcohol.

## *Bilateral Thoracoscopic Sympathectomy (BITS)*

The BITS procedure involves cutting the pain nerves from the pancreas as they travel through the chest towards the spinal cord in the spinal canal. The operation is done using fine instruments and telescopes using general anaesthetic and is surprisingly simple and safe to perform. This is so called 'keyhole' surgery. The operation lasts only 30 minutes and may be performed as an outpatient.

## **DOES PANCREATIC CANCER RUN IN FAMILIES?**

In general, the answer is NO. Nevertheless in rare cases there are families in which pancreatic cancer can run in families. These include the following.

- **Families with familial cancer syndromes** including Peutz-Jeghers Syndrome, Breast and Ovarian Cancer Syndromes, Familial

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Atypical Mole and Melanoma Syndrome and Familial Adenomatous Polyposis.

- **Hereditary Pancreatitis.**
- **Familial Pancreatic Cancer.**
- **Hereditary Pancreatic Neuroendocrine Tumours** including multiple endocrine neoplasia type 1 (MEN-1) and von Hippel-Lindau disease (VHL), neurofibromatosis type 1 and tuberous sclerosis.

Inherited pancreas cancer happens because there is an altered gene that predisposes to cancer and is passed on from one generation to the other.

## What Are Genes?

Each person has exactly the same number of genes as every other person. The total number of genes is 30,000. Genes are in the nucleus of each cell of the body. Genes are like the blueprints in a factory. These blueprints (or genes) enable the cell to make proteins which then organise the two other types of basic molecule (carbohydrates and fats) to create particular types of cell and hence the different organs (such as liver, arms and legs and so on).

In the cells of different organs only some of the 30,000 genes in the nucleus are selected for use. This number varies from 6,000 to 10,000 genes in any particular cell. The different combination of genes used as blueprints for making proteins is how the human body can be organised

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in such a complicated way (compared to a simple worm that has only 900 genes).

Genes are always in pairs, so that one set comes from the mother and one set comes from the father. There are tiny variations in each gene. These tiny variations are essential to make every person an individual. Occasionally a tiny variation in a gene can give rise to a disease condition. An alteration in a gene that gives rise to a disease is often referred to as a **mutation** (this is a Latin word that simply means 'changed'). Patients and their families with an inherited cancer risk require the care of a specialist surgeon, paediatrician or gastroenterologist and genetic counselling.

## Which Genes Are Involved In Pancreas Cancers?

- The main genes involved in all of the major familial cancer syndromes are known. The names of the genes sound quite strange so we only tend to use the short version name of each gene. The gene for Peutz-Jeghers Syndrome is the STK11 gene, the genes for Breast and Ovarian Cancer Syndromes are BRCA1 and BRCA2, the gene for Familial Atypical Mole and Melanoma Syndrome is the p16 gene and the gene for Familial Adenomatous Polyposis is the APC gene.
- The main gene for Hereditary Pancreatitis is the PRSS1 gene.
- The main gene for Familial Pancreatic Cancer is not known, although 10-20% of families have a BRCA2 gene mutation.
- The gene for multiple endocrine neoplasia type 1 is the MEN-1 gene.

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- The gene for von Hippel-Lindau disease is the VHL gene.
- The gene for neurofibromatosis type 1 is NF-1.
- The genes for tuberous sclerosis are the TSC-1 and TSC-2 genes.

### **Multiple Endocrine Neoplasia Type 1 (MEN-1)**

This is an autosomal dominant familial cancer syndrome (passed on by the mother or the father) with tumours in small glands in the neck (called parathyroids), a small gland attached to the brain (called the anterior pituitary) as well as the pancreas. The neuroendocrine tumours in the pancreas are usually multiple.

### **Von Hippel-Lindau (VHL)**

Von Hippel-Lindau disease is another type of rare autosomal dominant familial cancer syndrome (passed on by the mother or the father). This condition causes a multiplication of small blood vessels in the brain, spinal chord and back of the eyes and also cancers of the kidney and the small gland next to the kidney called the adrenal gland. About two thirds of patients with VHL also have a problem with the pancreas, but this is usually in the form of simple harmless cysts. About one in ten people with VHL however will also have one or more pancreatic neuroendocrine tumours (these are usually non-functioning).

## **SPECIAL FOLLOW UP OF PATIENTS WITH AN INHERITED PANCREAS CANCER RISK**

### **General Screening For Cancer**

Patients from families with familial cancer syndromes (including Peutz-Jeghers Syndrome, Breast and Ovarian Cancer Syndromes and Familial Adenomatous Polyposis) Hereditary Pancreatitis and Familial Pancreatic Cancer will need to undergo regular screening for cancer. Screening for

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cancer in high risk individuals is known as **secondary cancer screening**. The International Association of Pancreatology recommends that all patients be seen at a special pancreas centre. There is no standard set of methods at the present time and the following are only suggestions based on current practice in major pancreas cancer screening centres.

- In principle screening should start at the age of 40 years or ten years earlier than the youngest affected family member.
- All patients should have a baseline EUS and CT scan along with a tumour marker (such as CA 19-9). MRI is an alternative to a CT scan but **an abdominal ultrasound scan is not acceptable**.
- After this, the EUS and blood tests should be repeated every year.
- The CT scan or MRI scan can be repeated every three years, depending on EUS appearances.
- In the case of **Hereditary Pancreatitis** the pancreas may be so damaged as to invalidate the EUS, in which case CT or MRI are recommended annually.
- If possible participate in a research programme such as EUROPAC and provide pancreatic juice samples for experimental molecular testing every 1-3 years (see below for contact details).

## Genetic Testing in Familial pancreatic Cancer

- These families should undergo general secondary screening for cancer as above.
- A proportion of families with Familial Pancreatic Cancer will have a **mutation of the BRAC2 gene**. Individuals from these families must be referred for genetic counselling and BRCA2 gene testing.

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- The families should also be invited to join the European programme searching for the main Familial Pancreatic Cancer gene (includes EUROPAC, [see below for contact details](#)).

## Screening In Patients With MEN-1

Surveillance of carriers of the MEN-1 gene should begin in early childhood with blood tests every year and imaging every 3 years. Consensus guidelines have recommended screening from the age of 5 years for anterior pituitary tumours with blood tests (called prolactin and insulin like growth factor-1) and MRI and for insulinoma also MRI along with blood tests (called fasting glucose and insulin). Screening for parathyroid tumours should begin from the age of 8 years with blood tests (called calcium and parathyroid hormone) and for chest and abdominal tumours from the age of 20 years by CT. Other neuroendocrine tumours should also be screened from the age of 20 years using other blood tests (called chromogranin A, glucagon and proinsulin) and MRI, CT or octreotide scan. There should also be endoscopy for gastric tumours (carcinoids) and EUS for duodenal and pancreatic tumours.

## Screening In Patients With VHL

Surveillance of carriers of the VHL gene should begin at the age of 10yrs initially with abdominal ultrasound repeated annually looking to find tumours in the kidneys, adrenal glands and pancreas gland as well as the pelvis. From the age of 20yrs there should be 1-2 yearly abdominal CT or MRI scans. For the pancreas again EUS examinations are to be preferred.

## CAN I DRINK ALCOHOL?

You may drink alcohol if you wish. Indeed certain drinks such as English beer or stout are a good source of calories, iron and vitamins. Alcohol is

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not recommended for patients who have **chronic pancreatitis** or **hereditary pancreatitis**. If you are unsure about alcohol whilst you are having chemotherapy, you may check this with your medical oncologist.

A **unit of alcohol** is 100mls of 10% alcohol (by volume) equivalent to a half-pint of regular beer or lager, a regular glass of table wine, or a single measure of spirit. The **recommended intake for healthy adults** should be no more than 21 units per week for women and no more than 28 units per week for men.

## LIVING WITHOUT A PANCREAS

There are some patients who have had either their pancreas removed or who still have pancreatic tissue but which is not functioning at all. Both types of patient are perfectly able to lead a normal life provided they take regular enzyme supplements and insulin injections.

## PANCREATIC ENZYME SUPPLEMENTS



There are many preparations available. These preparations differ considerably in their effectiveness of action. The better preparations consist of capsules containing scores of small granules. The enzyme preparations can also be divided into two types depending upon their

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strength of action: regular and high dose. The capsules need to be taken during each meal and with any snack.

Requirements vary enormously from patient to patient: typically 20-30 high-dose capsules per day are required but this can be lower or much higher. The requirements vary greatly from patient to patient partly because of the different level of secretion by any functioning pancreas and partly because there are still some enzymes secreted by the salivary glands, tongue, stomach and small intestines but which also varies greatly from person-to-person.

In a few cases of children and adults with cystic fibrosis, a serious problem with the large bowel (colon) has been reported. This condition is called fibrosing colonopathy and causes narrowing of the bowel. It seems to be related to the use of a particular acid-resistant coating of the enzyme preparations (called methacrylic copolymer). The problem does not arise with preparations without this covering. The latter preparations are therefore recommended. The ingredients are always listed on the pack leaflet or label. Once patients are accustomed to taking enzyme supplements, they are usually allowed to adjust the number they take themselves to suit their own individual needs

### **INSULIN**

There are many types of insulin available including human insulin obtained by genetic engineering. Precise dosing and frequency of injections is an individual matter. Being under the care of a diabetic specialist is obviously important in the first instance.

### **Picture of an insulin pen (not syringe)**

### **GASTRIC ACID SUPPRESSING TABLETS**

## Picture of tablets

Medication of this sort is often prescribed to be taken once or twice a day. Pancreatic juice normally counters the acid of the stomach. In the absence of the pancreas, there may be excess acid which can cause dyspepsia. There is also some evidence that taking this type of medication helps the action of pancreatic enzyme supplements which means that fewer capsules are required each day.

## LIVING WITHOUT A SPLEEN

Pancreatic surgery sometimes necessitates removal of the spleen. This is much more of a problem in children than in adults. Without the spleen there is a small but real risk of developing a serious infection caused by certain bacteria especially pneumococcus. All children and adults without a spleen therefore require regular pneumococcal vaccination. All patients should also receive **vaccination for meningococcus groups A and B**, and **children less than 4 years old require Haemophilus influenzae type b** vaccination. Children will also need to take a daily antibiotic. The risk is much less in adults, but nevertheless daily antibiotics are usually prescribed. Nevertheless if any infection develops, then appropriate antibiotics (such as **penicillin or erythromycin**) must be taken over-and-above any other types of antibiotic that are required.

Removal of the spleen sometimes causes the number of platelets in the blood to increase. This increases the risk of developing unwanted blood clots. Regular blood tests are therefore needed. If the number of platelets in the blood rises excessively, it is common practice to prescribe **low-dose aspirin** which reduces the risk of undesirable clotting.

## DOCTORS DEALING WITH PANCREATIC DISEASE THAT YOU MAY MEET

All surgeons are called 'Mr' and other medically qualified doctors are called 'Dr'. Either may be called 'Professor' if they work for a University. Senior doctors are called 'consultants' and the junior doctors are called house officers, senior house officer and registrar. In University departments, they are also called 'lecturer' (registrar) and 'senior lecturer' or 'reader' (consultants).

### **Dietician**

This is a specialist who is not a doctor but is an expert in advising on various types of diet.

### **Endocrinologist**

A physician who is highly specialised in glandular problems including sugar diabetes.

### **Endoscopist**

This may be a gastroenterologist, radiologist or a surgeon who is able to undertake endoscopy (examination of the stomach or bowel using a flexible telescope). A few endoscopists can also perform ERCP and EUS, which are specialist forms of endoscopy that examine the biliary and pancreatic ducts and the pancreas

### **Gastroenterologist**

A physician who is highly specialised in 'gut' problems and is also usually an 'endoscopist'.

## **General physician**

A consultant medical doctor who works in a hospital and who is broadly specialised including 'gut' problems.

## **General surgeon**

A consultant surgeon who works in a hospital and who is broadly specialised including 'gut' problems.

## **Geneticist**

A consultant who specialises in diseases which may be inherited and may be able to provide additional help to that normally given by your other specialist doctors.

## **Medical Oncologist**

A special medical doctor who gives drugs and other treatment for cancer.

## **Nutrition team**

A team of specialist doctors and nurses involved in providing specialist nutritional support, including the insertion of venous access lines and special stomach tubes to help patients who are unable to eat properly.

## **Paediatrician**

A consultant who specialises in the care of children and who may be called to investigate a pancreatic problem in young children or teenagers.

## **Pain team**

A team of specialist doctors who specialise in providing special treatment measures and support for patients who are experiencing difficulties in pain control.

## **Pathologist**

This is a specialist doctor who examines tissue under the microscope. The pathologist is extremely important as it is only they who can definitely say if you have cancer or not. The pathologist is also very important in saying what type of cancer you have as this will determine the best type of treatment and outcome.

## **Radiotherapist**

A specialist medical doctor who gives X-ray treatment for cancer. Some radiotherapists are also expert medical oncologists.

## **Radiologist**

A consultant who specialises in taking X-rays and scans of various sorts at the request of other specialists.

## **Specialist surgeon**

A general surgeon who is highly specialised – a so called PB-specialist is a pancreato-biliary surgeon.

## **USEFUL ORGANISATIONS**

### **Pancreatic Society of Great Britain and Ireland**

This is a professional organisation of specialist doctors involved in the care of patients with pancreatic disease. The Society is allied to the European Pancreatic Club and the International Association of Pancreatology.

Write to:

Mr Ross Carter,

Secretary, Pancreatic Society of Great Britain and Ireland,

Consultant Surgeon,  
Glasgow Royal Infirmary  
84 Castle Street,  
Glasgow, G4 0SF.  
Tel: 0141 211 5129  
Fax: 0141 211 4991  
[rcarter@clinmed.gla.ac.uk](mailto:rcarter@clinmed.gla.ac.uk)

## **Pancreas Research Fund**

Specifically supports basic and clinical research of all diseases of the pancreas.

Write to:

Professor JP Neoptolemos,  
Department of Surgery,  
Royal Liverpool University Hospital,  
Daulby Street,  
Liverpool, L69 3QA.  
Tel: 0151 706 4175  
[j.p.neoptolemos@liv.ac.uk](mailto:j.p.neoptolemos@liv.ac.uk)  
<http://www.liv.ac.uk/surgery/about.html>

## **Digestive Disorders Foundation**

Supports research into digestive diseases.

Write to:

3, St Andrew's Place,  
London, NW1 4LB.  
Tel : 0207 486 0341  
<http://www.digestivedisorders.org.uk>

## **EUROPAC**

European Register for Familial Pancreas Cancer and Hereditary Pancreatitis. The principal register in Europe providing advice and research in inherited pancreatic disorders.

Write to:

EUROPAC Co-ordinator,  
Department of Surgery,  
Royal Liverpool University Hospital,  
Daulby Street,  
Liverpool, L69 3QA.

[europac@liv.ac.uk](mailto:europac@liv.ac.uk)

<http://www.liv.ac.uk/surgery/europac.html>

## **Pancreatic Cancer Research Fund**

This organisation is dedicated to providing independent support to fund research for finding new ways to combat pancreatic cancer.

Write to:

Pancreatic Cancer Research Fund,  
51 Cheyne Walk,  
London, N21 1DB.

[maggie.blanks@tiscali.co.uk](mailto:maggie.blanks@tiscali.co.uk)

## **CancerHelp UK**

CancerHelp UK is a free information service about cancer and cancer care for people with cancer and their families and is brought to you by Cancer Research UK. The information about cancer is freely available to all and written in a way that people can easily understand.

The specific pancreatic cancer web page is:

<http://www.cancerhelp.org.uk/help/default.asp?page=2795>

## **CancerBacup**

This also provides information about pancreatic cancer and provides a telephone help line.

<http://www.cancerbacup.org.uk/Resourcessupport/Talkingaboutcancer>

## **Pancreatic Cancer UK**

A support and action network of patients, caregivers and those affected by pancreatic cancer. It is dedicated to providing information on pancreatic cancer to patients, caregivers and GPs, providing a support

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network, raising awareness of pancreatic cancer to aid earlier diagnosis and to stimulate more research into better treatment.

<http://www.pancreaticcancer.org.uk>

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