Acute Pancreatitis

WHAT'S WRONG WITH MY PANCREAS

A guide for patients

3rd Edition

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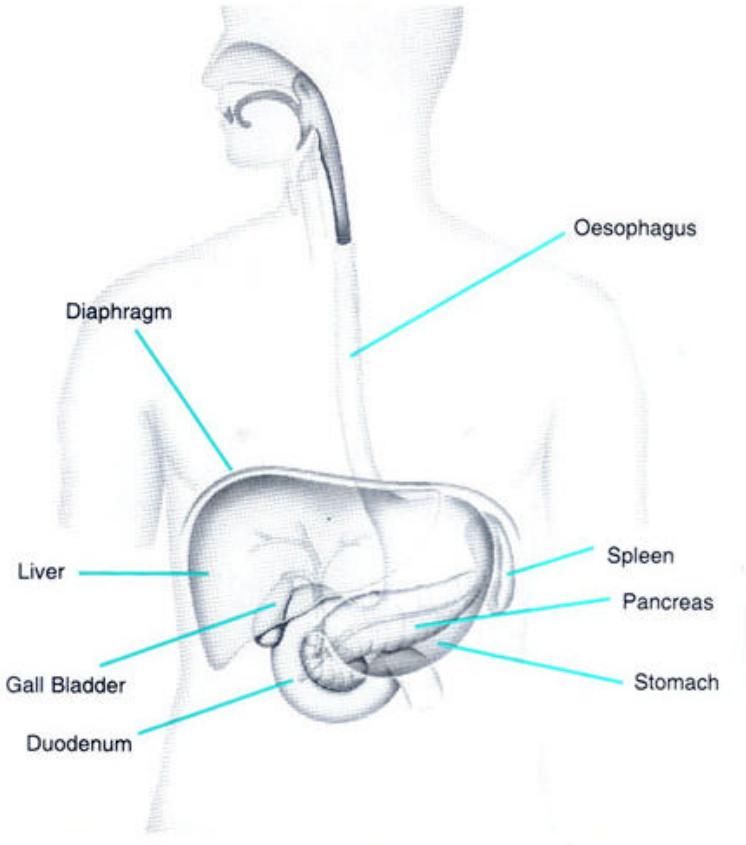
INTRODUCTION

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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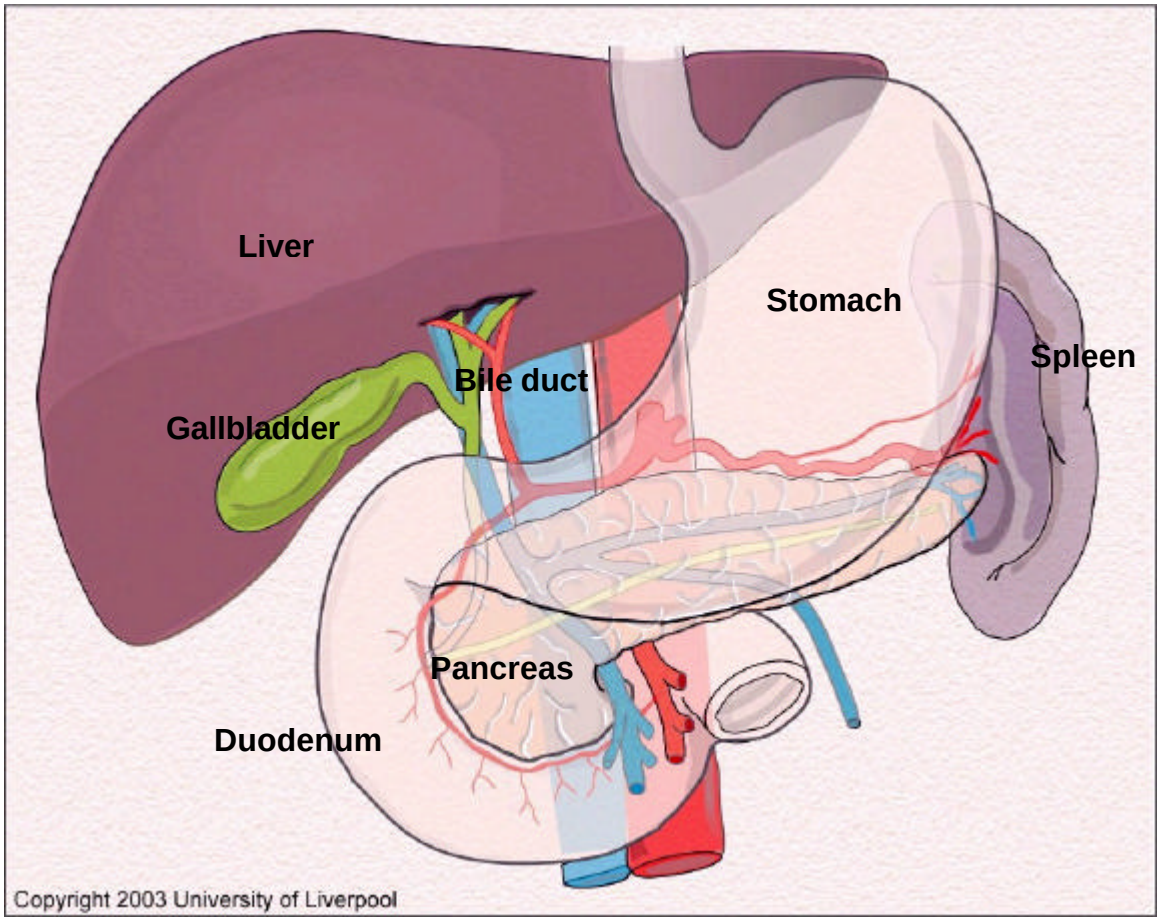
WHAT IS THE PANCREAS?

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 uncinate 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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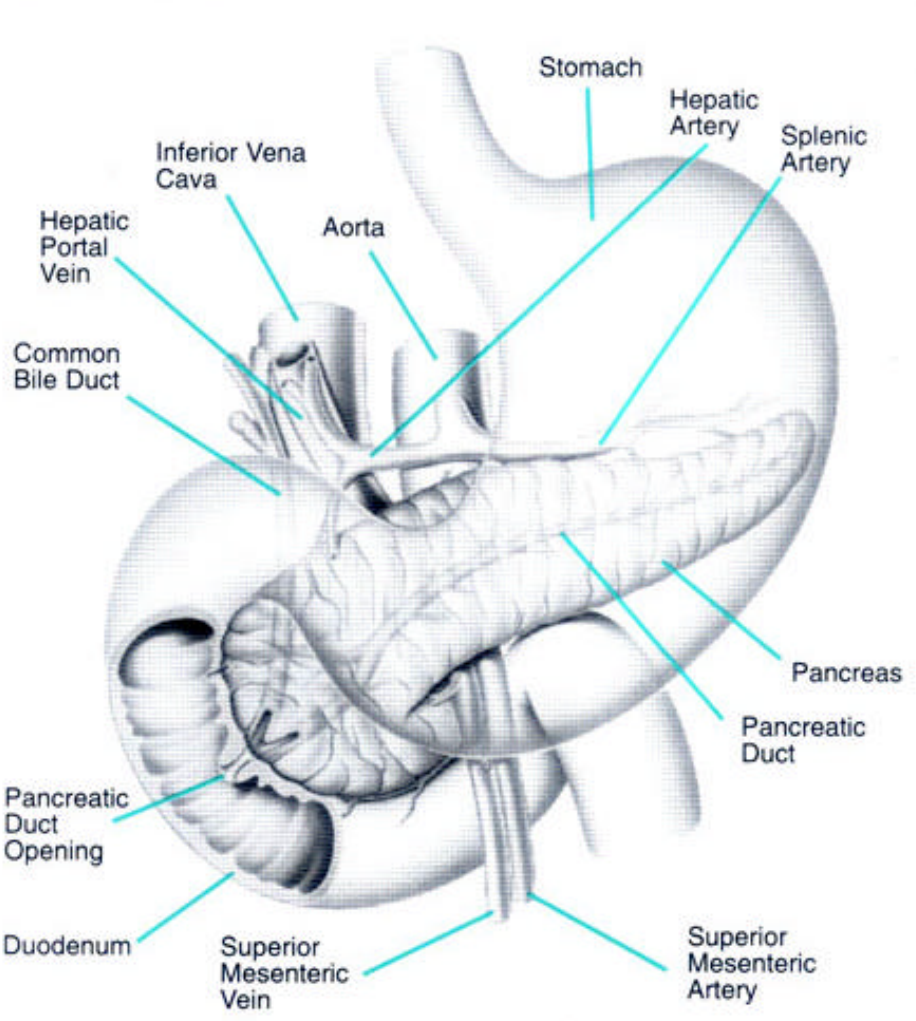
The uncinate process is an extension of the lower part of the head of the gland which surrounds important blood vessels. The body and tail of the pancreas lie at an angle so that the tail of the pancreas is situated beneath the extreme edge of the left rib cage. The tail of the gland is closely attached to the central part of the spleen with which it shares a common blood supply. Running behind the neck and uncinate 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



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 (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).

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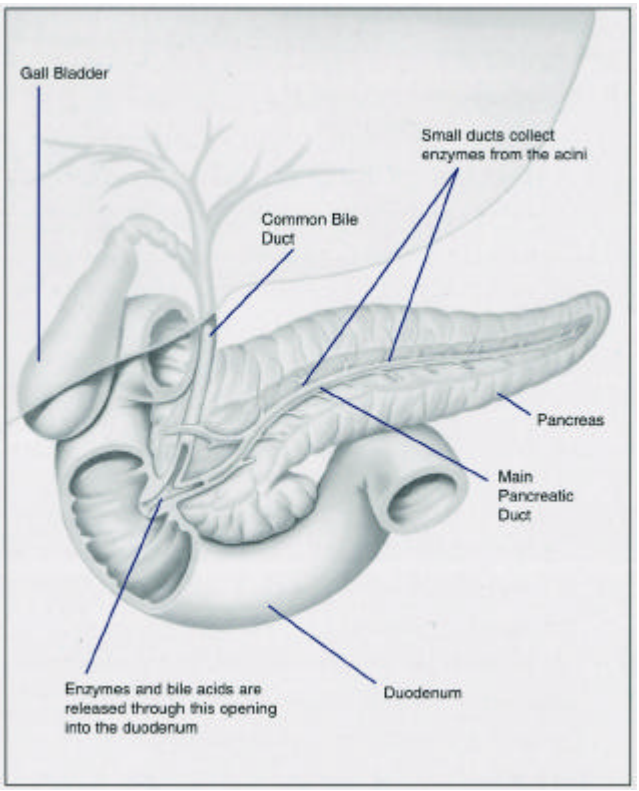
The enzymes when they are first made in the acini are not active (otherwise they would digest the pancreas as well!). When they pass into the duodenum however, they are made active by the juice of the duodenum. The main enzymes are called amylase for digesting carbohydrates, trypsin for digesting proteins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



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.

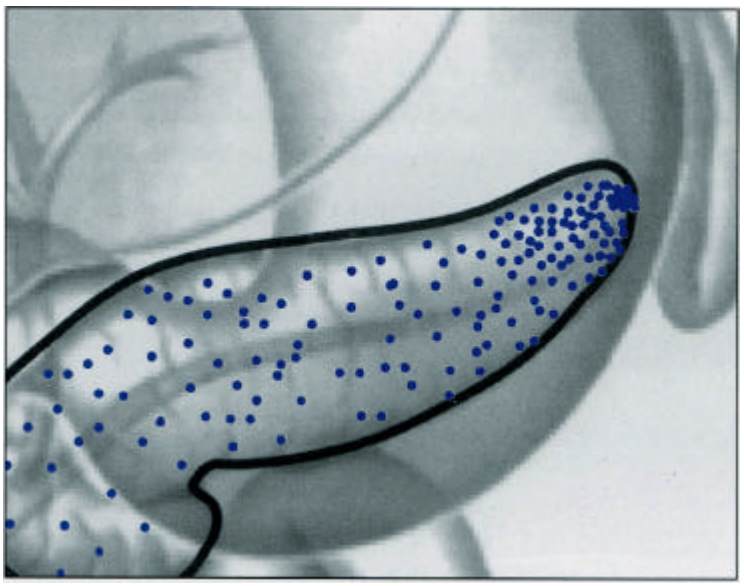
For the same reason, if the main bile duct becomes blocked, then the bile cannot get into the duodenum, fat cannot be properly digested and the stools are again pale in colour. Because the bile made by the liver cannot go into the bowel it goes into the blood and out through the kidneys into the urine. 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

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:

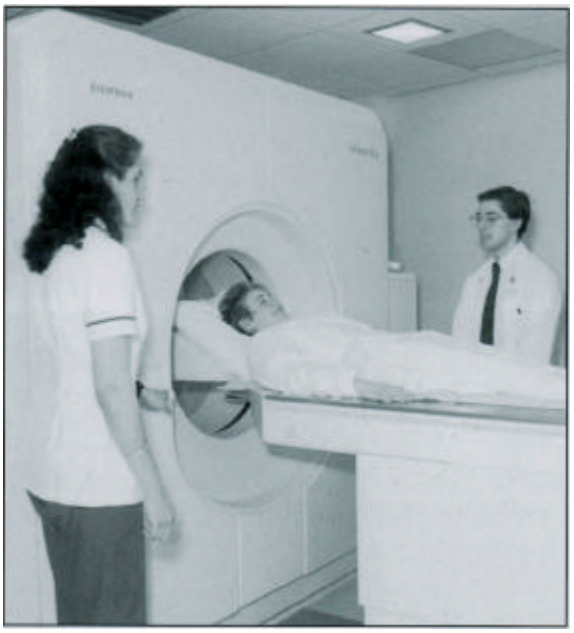
This is a simple, painless and relatively quick investigation which can be used to obtain a 'picture' of the inside of the abdomen. The only preparation needed is for you to avoid eating for 6-8 hours prior to the test, as any fluid or food which is taken by mouth can obscure the pictures produced. Pictures 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)

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^{o}. 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.



NEEDLE BIOPSY OR CYTOLOGY

USING ULTRASOUND OR CT SCAN

Occasionally a small piece of tissue from the pancreas needs 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 needle is used it is called a **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 **aspiration cytology**.

Are needle biopsy and aspiration cytology safe?:

These procedures are surprisingly safe 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 and usually additional to that given by ultrasound or CT.

EUS is performed using a 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 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**.

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.

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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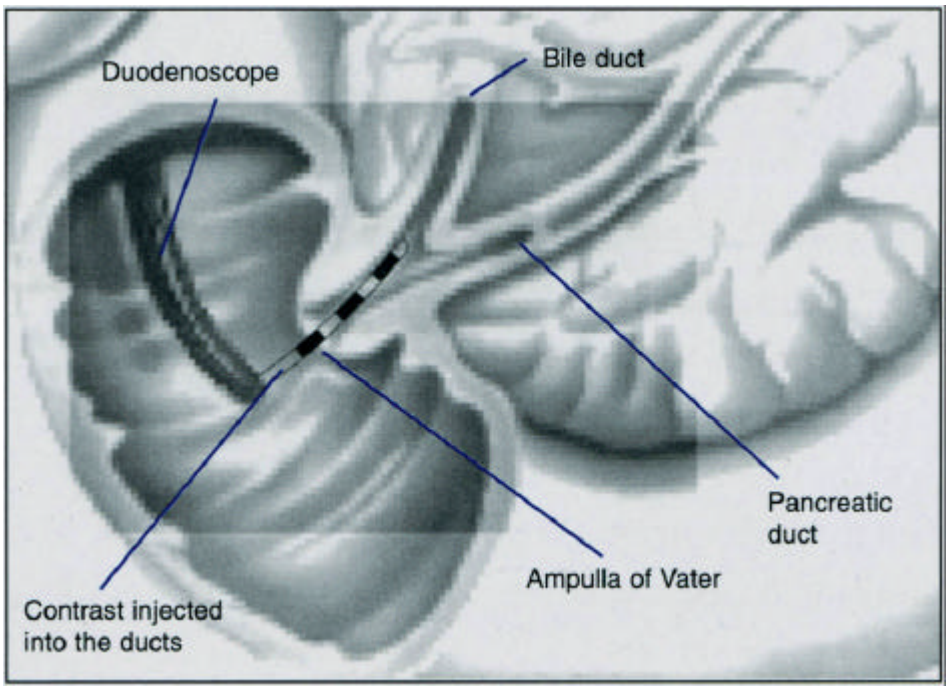
This is a special investigation for taking pictures of the bile and pancreatic ducts and is mainly used for **treatment of bile duct and pancreatic duct problems**. The full name of ERCP is rather a mouthful: endoscopic retrograde cholangio-pancreatography! As with EUS it involves inserting a flexible 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.



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

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 **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 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.

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 or having a gallstone 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 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 RESONACE 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 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.

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 a 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.

ACUTE PANCREATITIS

This section of the booklet deals with the particular problem you have with your pancreas – "acute pancreatitis". So what is it, what causes it, and how can it be treated?

WHAT IS ACUTE PANCREATITIS?

This is an inflammation of the pancreas. It develops very suddenly and, in the majority of patients (about 75%) improves steadily with good hospital treatment over the course of a week or so. A blood sample usually shows the presence of a large amount of amylase (a pancreatic enzyme) in the blood.

There are many causes of acute pancreatitis, and it can affect people of any age. Once a patient has recovered from an attack of acute pancreatitis, they are perfectly well and there is usually no permanent damage to the pancreas.

It is very important to find out the cause of acute pancreatitis, which must then be dealt with otherwise further attacks may follow. If more than one attack of acute pancreatitis occurs, it is called **recurrent acute pancreatitis**.

CAUSES OF ACUTE PANCREATITIS
Common Causes
Gallstones
Sensitivity to alcohol
Unusual causes
Hyperlipidaemia (too much fat in the blood)
Narrowing of the pancreatic duct
Pancreas divisum
Annular pancreas
Trauma
Surgery
Pregnancy
Mumps
Autoimmune
Idiopathic
Hereditary

GALLSTONES

This is by far the commonest cause of acute pancreatitis. Because gallstones affect women more commonly than men, acute pancreatitis usually affects women and even teenagers. Not all patients with known gallstones however develop acute pancreatitis – the figure is about 1 in 15 only. Gallstones cause acute pancreatitis because they pass into the bile duct and temporarily block the opening into the duodenum at the point where it is joined by the pancreatic duct (see the diagram on page XX).

In severe cases, patients may benefit from an emergency ERCP and cutting the lower end of the bile duct. This cutting is called **'endoscopic sphincterotomy'** and makes the opening of the lower bile duct bigger which allows any stones to pass through into the duodenum without causing blockage.

Once symptoms have improved the best way to prevent further attacks of acute pancreatitis is to have the gallbladder removed ('cholecystectomy'). This operation is now done best by keyhole surgery – so called **laparoscopic cholecystectomy** or 'lap chole' – under a general anaesthetic.

Elderly patients may not be suitable for a general anaesthetic. An alternative to a 'lap-chole' is to cut the lower end of the bile duct during ERCP. This cutting (endoscopic sphincterotomy) causes complications in about 10% of cases and very occasionally a patient dies as a result. This risk is worth taking in an elderly patient who cannot have a 'lap-chole'. On the other hand the risk of endoscopic sphincterotomy complications may be too high in younger patients when a 'lap-chole' is safer.

ALCOHOL

This is the second commonest cause of acute pancreatitis overall although in some countries, it is perhaps a commoner cause than gallstones.

It is not known how alcohol causes acute pancreatitis. Some people have a pancreas which is sensitive to the effects of alcohol. These people develop attacks of acute pancreatitis a few hours or 1-2 days after they have been drinking alcohol. Often the sensitivity only develops after they

have been drinking for several years. Such people may only be drinking a moderate amount of alcohol (not 'heavy' drinkers).

Other people who are much heavier drinkers may never develop acute pancreatitis but instead develop liver cirrhosis. Some patients who drink alcohol in moderate amounts never develop either acute pancreatitis or liver cirrhosis.

If alcohol is the cause of your acute pancreatitis, it is essential that you stop all future alcohol drinking. Non-alcoholic drinks mimicking wine or beer are now reasonable substitutes. Low-alcoholic (LA) drinks should also be avoided however.

HYPERLIPIDAEMIA

This refers to an excessive level of lipids (particles of fat) in the blood. Lipids are essential to life and need to be transported by the blood from one tissue to another. Certain individuals have unusually high lipid levels in the blood and this can cause acute pancreatitis. Patients who drink a large amount of alcohol can also develop hyperlipidaemia. Not all lipids are the same and it is only a certain pattern of lipids which is associated with acute pancreatitis. For example, individuals who have a high blood cholesterol level are predisposed to heart disease and a high blood pressure but are not usually predisposed to developing acute pancreatitis. Hyperlipidaemia is not a common cause of acute pancreatitis – it accounts for no more than 5% of cases. The diagnosis is made by measuring blood lipid levels at the time of an attack of acute pancreatitis. At other times, the blood lipid levels may be normal.

Treatment involves adopting a low fat diet. Occasionally special drugs need to be taken which can lower the level of abnormal lipids in the blood.

NARROWING OF THE PANCREATIC DUCT

There are many different reasons why the pancreatic duct becomes narrowed. For this reason, it is important not only to show that the pancreatic duct is narrow but also the cause for this. Surgery is often required to deal with pancreatic duct narrowing.

PANCREAS DIVISUM

The pancreas develops as two separate buds from the intestinal tube during embryological development of the foetus in the womb. These buds each have a separate pancreatic duct. The two buds eventually combine together before birth to form a solid single organ. When this occurs, the separate pancreatic ducts also combine. In about 10% of healthy individuals, the pancreatic tissue combines but the two pancreatic ducts remain divided and they empty separately into the duodenum. This situation is called pancreas divisum because the pancreatic ducts remain divided.

Pancreas divisum is not harmful in the vast majority of cases. Very occasionally one of the ducts becomes narrowed and this can result in recurrent attacks of acute pancreatitis. Sometimes this may eventually lead to chronic (or continuous) pancreatitis.

The treatment involves enlarging the narrowed pancreatic duct opening and can occasionally be done by **endoscopic sphincterotomy** (see above). An open operation can also be performed that involves opening

the duodenum and is called **trans-duodenal sphincteroplasty.** The operation may involve enlarging both the biliary and pancreatic sphincters (see above) and is therefore called a **double sphincteroplasty.** If the pancreatic duct is very distended then this can be drained into a piece of bowel and the operation is called a **Roux-en-Y lateral pancreato-jejunostomy**. If the head of the pancreas is damaged by the pancreatitis sometimes it may be necessary to remove a part of the pancreas (**Beger's operation**).

ANNULAR PANCREAS

This is an extremely rare cause of acute pancreatitis which often affects small children but which can affect adults. The problem arises during embryological development of the two pancreatic buds as described above (see pancreas divisum). In simple terms, the head of the pancreas becomes partly or totally wrapped around the duodenum. This can cause an obstruction to the flow of food in very young babies. The usual operation for this is called a **side-to-side duodeno-duodenostomy**. Alternatively the flow of pancreatic juice along the pancreatic duct may be hindered leading to acute pancreatitis. This may be difficult to recognise but once it is, surgery is required. The type of surgery will depend on the exact nature of the pancreatic duct blockage.

TRAUMA

Any major blunt trauma to the abdomen may cause acute pancreatitis.

SURGERY

This is also another rare cause of acute pancreatitis. Surgery performed to organs which lie near the pancreas such as the stomach or kidneys can cause acute pancreatitis. For reasons we do not understand, surgery to

organs well away from the pancreas (such as the prostate gland, heart and brain) can also cause acute pancreatitis.

PREGNANCY

A small number of women develop acute pancreatitis during pregnancy. The cause is not the pregnancy itself but another underlying reason. Investigation nearly always shows that the cause is due to gallstones because in some women pregnancy speeds-up the development of gallstones.

MUMPS

Children may occasionally develop acute pancreatitis if they develop mumps which is a viral infection. Sometimes children will have a high amylase level in the blood due to the virus affecting the salivary glands in the neck. This might cause some confusion at first to the doctors looking after the child. A simple ultrasound scan of the pancreas helps to make the diagnosis or rule-out the possibility of pancreatitis. Mumps-associated pancreatitis usually resolves and does not recur.

AUTOIMMUNE PANCREATITIS

This is a rare condition that causes acute pancreatitis. The actual cause of the condition is not known. In the pancreas of this condition there are many cells of the type that make antibodies and other cells involved with immunity. This is why it is called autoimmune pancreatitis. The diagnosis is extremely difficult to make. There is often obstructive jaundice and a swelling in the head of the pancreas. It is therefore not surprising that it is often confused with chronic pancreatitis or a tumour in the head of the pancreas. In fact the correct diagnosis is usually only made after major surgery to remove the head of the pancreas (Kausch-Whipple operation).

The condition will respond to a course of steroids and pancreas enzyme supplements.

IDIOPATHIC

This is a loosely applied term used by doctors to mean "the cause is specific to an individual person" – in other words the cause is not known for certain. Many patients initially diagnosed as 'idiopathic' turn out to have a known cause – such as tiny gallstones missed by routine investigations. There are lots of other possible reasons for an initial diagnosis of idiopathic pancreatitis such as certain types of drugs, for which there is no convincing evidence. Patients with idiopathic acute pancreatitis pose a problem because if the specific cause is not known, then no specific treatment can be given. In this case, it is important that the search for a cause should be thorough. Ultimately, the doctor has to guess as to the likely causes and advise the patient appropriately.

The pancreatitis can begin in children or young adults and is referred to as **juvenile-onset idiopathic pancreatitis**. Alternatively it may first begin in older adults and is referred to as **late-onset idiopathic pancreatitis.**

There may be a genetic basis to the pancreatitis. This often involves an alteration to a gene called **SPINK-1** or an alteration to a gene called the **cystic fibrosis gene**, which is also called the CFTR gene. Inheritance in pancreatitis is explained in more detail below

DOES ACUTE PANCREATITIS RUN IN FAMILIES?

In general, the answer is NO. Because acute pancreatitis is common and there are many causes of this, simply by chance two or more members of a family may suffer from acute pancreatitis. For example, it would not be

surprising if a mother and her adult daughter both developed gallstones and that both developed an attack of acute pancreatitis. Nevertheless **pancreatitis can run in families** and falls into two types: hereditary pancreatitis and some forms of idiopathic pancreatitis.

INHERITED PANCREATITIS

Inherited pancreatitis happens because they have an altered gene which predisposes to pancreatitis.

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 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 inherited pancreatitis require the care of a specialist surgeon, paediatrician or gastroenterologist and genetic counselling.

Hereditary Pancreatitis

In this type of inherited pancreatitis there is a tiny variation in the **cationic trypsinogen gene**. The trypsinogen gene provides the blueprint to make a protein called trypsinogen. Trypsinogen is not active in any way and itself is quite harmless. During a meal trypsinogen is secreted into the main pancreatic duct and then into the duodenum. Trypsinogen is then made very active by the removal of a protective cap at one end of the molecule. Once this cap has been removed it is now called **trypsin**, which is also an enzyme and is now very active. As mentioned above trypsin is also an enzyme and is used to digest the proteins in foods such as meat.

What happens in hereditary pancreatitis is that the protective cap of trypsinogen is removed in the pancreas. This unfortunately results in active trypsin in the pancreas. This activation occurs before it has had a chance to be secreted into the duodenum. This activated trypsin then begins to attack other proteins actually within the pancreas and causes acute pancreatitis.

The gene is officially called the **PRSS1 gene** and the two commonest alterations (or gene mutations) are called **R122H** and **N29I**. There are however 20 or so different mutations that have been discovered. Affected individuals tend to develop pancreatitis as children, adolescents or young adults. There may be other members of the family with sugar diabetes. Not all members of the family will be affected in the same way.

On average only half the individuals will carry the altered gene. The altered gene can be passed on by either the father or the mother and only one altered gene needs to be passed on to cause pancreatitis. The technical term for this kind of inherited disease is **autosomal dominant**. ('Autosomal' refers to the fact that is not linked to the sex genes and 'dominant' means that the altered gene is stronger than the normal gene).This means that half the children of an affected parent will have the gene passed on to them. Even then, some members of the family (about 20%) with the altered gene will not be affected at all. We call this **80% penetrance** because the disease will only 'penetrate' into 80% of people with altered gene.

The presence of the gene can be tested for by a single blood test. Genetic counselling is required before any tests can be performed. **Some families with hereditary pancreatitis have a normal set of PRSSI genes.** This means that another gene is affected and scientists are trying to find out which one this is.

Idiopathic Pancreatitis

Up to half of all patients with idiopathic pancreatitis (see above) have inherited one of two other altered genes that can trigger pancreatitis. One is called SPINK-1 and the other is called CFTR.

In order to protect the pancreas against accidental conversion of trypsinogen to trypsin, humans have been equipped with a safety mechanism called **SPINK-1**. This is a special enzyme that destroys any active trypsin in the pancreas and hence stops pancreatitis from occurring.

Unfortunately some individuals have an alteration in SPINK-1 called the **N34S mutation,** which destroys the safety mechanism.

About one in fifty people have the N34S mutation but less than 1% of these people ever get acute pancreatitis. In other words this altered gene has less than 1% penetrance, or **very low penetrance**. This means that there is some other reason as well for the pancreatitis. This means that even though the N34S mutation was inherited from either the mother or the father, the parents are usually not affected. Also this means that the disease is very unlikely to be passed on to the children even though there is a fifty-fifty chance that the N34S mutation will be passed on to them.

Some patients have an alteration in the gene that causes **cystic fibrosis, known as the CFTR gene**. This gene provides the blueprint that makes a protein also called CFTR. This protein regulates the passage (or conductance) of small molecules through the outer surface (or membrane) of the cell. An alteration in both genes (the one from the mother and the one from the father) causes the disease called cystic fibrosis. For all of these reasons the full name of the gene is the cystic fibrosis transmembrane conductance regulator gene.

One in 20 of the normal population has a CFTR gene mutation but only a tiny handful has idiopathic pancreatitis. Individuals with cystic fibrosis disease have both of the CFTR genes altered. People with idiopathic pancreatitis only have one CFTR gene mutation (either from the mother or from the father). This type of genetic disease is therefore called **autosomal recessive**. We do not understand why some people with only one CFTR gene mutation develop pancreatitis. Scientists are trying to find out why this happens.

In these rare forms of pancreatitis, the symptoms begin as acute pancreatitis and usually progress to chronic pancreatitis. This also applies to a number of other causes of acute pancreatitis but gallstones never cause chronic pancreatitis.

SEVERE PANCREATITIS AND ITS COMPLICATIONS

We do not know why some patients develop severe pancreatitis. Once this occurs, then the chances of complications and death are quite high. Because we still do not understand all the factors responsible for causing the various complications, treatment is sometimes not successful and patients can unfortunately die. For these reasons, it is important that patients with severe pancreatitis are looked after by specialists if this is at all possible.

Severe pancreatitis places a stress on all the main organs of the body: the heart, lungs, kidneys, other gut organs, the brain and the peripheral vasculature (the blood vessels that nourish all the organs). Patients who are elderly are less capable of coping with these stresses. Equally, for reasons we do not understand, some young people also cannot cope with the stresses and death will occur despite every effort on the part of those caring for them.

TREATMENT OF SEVERE PANCREATITIS

At first, patients will be transferred to a High Dependency Unit (HDU) for intensive monitoring and given intravenous fluids and oxygen by mask. If the cause is due to gallstones, an ERCP and endoscopic

sphincterotomy may be performed (see pages xx and xx.). Most patients recover from acute pancreatitis but some require to be transferred to an Intensive Therapy Unit (ITU). This is necessary for assisted ventilation of the lungs and to treat kidney failure by haemofiltration or dialysis.

Pancreatic Necrosis

One or more CT or MRI scans will be necessary to assess the state of the pancreas. There may be severe death of the tissue (necrosis) of the pancreas or tissues surrounding the pancreas. It is common to see one or more **acute fluid collections** in the abdomen. These are usually quite harmless and disappear without specific treatment.

Only the CT or MRI can reliably show whether there is **pancreatic necrosis** (or gangrene of the pancreas). This usually does not fully appear until a week or so after the start of the illness. If there is necrosis it is important to know whether this is infected (called **infected pancreatic necrosis**) or not infected (also called **sterile pancreatic necrosis**). Infected pancreatic necrosis is similar to wet gangrene (and needs urgent removal) and sterile pancreatic necrosis is similar to dry gangrene (and usually improves without specific removal).

It is not usually possible to tell from the CT or MRI whether the pancreatic necrosis is infected or not. The best way to do this is by inserting a needle into the dead pancreas and removing some tissue for inspection for bacteria and fungi. A very fine needle is passed into the pancreas using CT and the dead tissue sucked up (or aspirated) into a syringe. The procedure is therefore done in the X-ray department. The samples are examined under the microscope but it is usually difficult to see the bacteria and /or fungi. Therefore these are also cultured in the

microbiology department. This means that the results may not be available for 24 hours or so. For these reasons this procedure is known **as fine needle aspiration for bacteriology and fungi**, or **FNABF.** Most patients with extensive pancreatic necrosis will have FNABF performed at least once. Some patients will need this to be done two or more times (usually at weekly intervals) before the doctors are sure whether there is infection or not.

If the necrosis is extensive or if there is evidence of infection of the necrosis, then surgery will be needed. The timing of the surgery and the extent of surgery are difficult decisions to make even for experienced pancreatic surgeons. Once it is decided to operate for severe necrosis, the likelihood of success is anywhere between 20% and 80%, but this depends very much on individual cases.

The procedure used for removing extensive pancreatic dead tissue (necrosis) is called a '**necrosectomy**'. The procedures that are used include the following.

Open Necrosectomy:

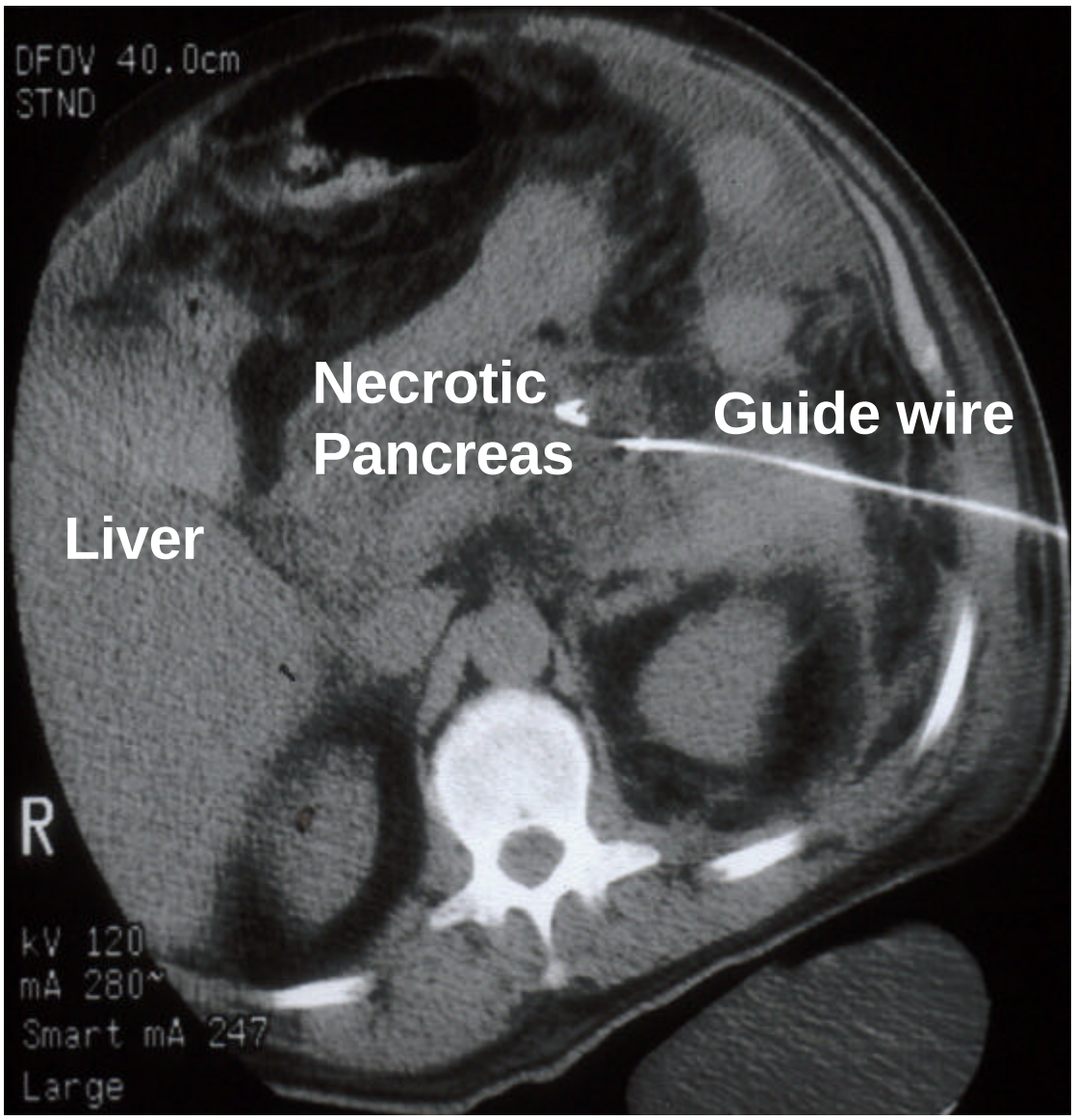
This requires a large operation to remove dead pancreatic tissue and a general anaesthetic is required. For several weeks (or longer) tubes are left behind for continuous wash out of small pieces of dead tissue (**lavage**). More than one operation may be necessary.

Minimally Invasive Necrosectomy:

It may be possible to remove dead pancreatic tissue using "keyhole" surgery. The advantage is that the success rate may be better in very ill and elderly patients compared to open necrosectomy. This involves

inserting a guide wire into the pancreas necrosis using CT in the X-ray department (see picture).

The patient is then taken to the operating theatre where a telescope is introduced along the guide wire into the pancreatic necrosis. The dead tissue is removed. As with open necrosectomy a large tube is left in the middle of the dead pancreas for continuous washout. This procedure is often referred to as **'skunking'.** This procedure can often be done using local anaesthetic and mild sedation and usually has to be repeated several times. It is only available in a few specialised centres.



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The process of clearing all of the pancreatic necrosis can be very time consuming and may take weeks or months. It is very important that you remain patient. In order to discharge patients as soon as possible it is likely that the drainage tube will still be present when you go home. A district nurse will see you regularly to help you empty the bag. You will be seen regularly in outpatients and the tube will slowly be shortened be fore it is finally removed.

Keeping your weight up during the illness can be very difficult. At all times you will be encouraged to eat by mouth and drink what fluids you can. You will be seen by the nutritionist who will advise on other ways to improve your calorie intake. This includes the insertion of an **NG tube** into the stomach (**naso-gastric tube**) and giving you a continuous liquid diet down this tube. If you are unable to tolerate the NG tube a narrow tube will be inserted into the small bowel (jejunum) using a flexible endoscope. This is like regular endoscopy and is done with local anaesthetic spray to the back of the throat and intravenous sedation. The tube is call an **NJ tube or naso-jejunal tube** and the feeding with a liquid diet slowly dripped in using this tube is called **naso-jejunal feeding.**

Sometimes extra feeding has to be given straight into a vein and is called **parenteral feeding**. This can be done by inserting a long catheter (tube) into a vein in one of the arms and then the tip is pushed into one of the large veins close to the heart (this is called a **PIC line**). If the arm veins are collapsed then a catheter will need to be pushed into one of the neck veins and then the tip is pushed towards the large veins near the heart. This is sometime called **TPN or total parenteral nutrition**.

Once you are over the worst of the worst of the severe pancreatitis but you are still unable to keep your weight up despite eating some food by mouth you may be fed with a **PEG tube** (percutaneous endoscopic gastrostomy). A PEG tube is inserted using a flexible endoscope, inflating the stomach with air and pushing a guide wire through the skin into the stomach. A permanent feeding tube is then passed over the guide wire into the stomach. With a PEG tube you can eat and drink as much as you feel like. Any extra calories can then be given using a liquid diet dripped into the PEG tube. You may well be sent home with the PEG tube still present, in which case you will be helped by a community nurse.

Failure to survive a severe attack of acute pancreatitis despite all the treatment on ITU and surgery is due to the inability of the different organs to cope with the stress of acute pancreatitis. In young people, even though the heart and lungs respond to drugs and ventilation and the kidney function is replaced by dialysis, the peripheral vasculature becomes unresponsive to drugs. The blood pressure then falls and it becomes impossible to keep the patient alive.

On the whole, most patients tend to survive an attack of severe acute pancreatitis although this may take several months of treatment in hospital. Despite an overall improvement at a later stage, localised complications may develop, which are principally a pseudocyst or an abscess (see below).

Splenic vein thrombosis:

A thrombus simply means blood clot. In severe necrotising pancreatitis it is quite common for the splenic vein to become blocked off because of a clot. This is because the pancreatitis irritates the splenic vein to cause the

clot. Once the pancreatitis is cured the clot is usually dissolved normally by the body. Sometimes however the clot and blockage of the splenic vein becomes permanent and you are now at risk of **venous bleeding** (bleeding from the system of veins). The treatment of venous bleeding is described below.

Hepatic portal vein thrombosis:

This is an unusual complication of severe necrotising pancreatitis. The pancreatitis irritates the hepatic portal vein to cause a clot. There is a risk that the clot and blockage of the hepatic portal vein will become permanent and cause **venous bleeding** (bleeding from the system of veins) or a build of fluid in the abdomen (**ascites**). The treatment of venous bleeding and ascites is described below.

It may be possible to clear the clot (also called a **thrombectomy**) in the hepatic portal vein using a procedure performed in the X-ray department. Usually using local anaesthetic (but sometimes requiring a general anaesthetic) a wire is pushed through the skin and into one of the branches of the hepatic portal vein within the liver. The guide wire is then advanced towards and through the blood clot. A special miniature wire basket is then used to try and retrieve the blood clot. The full name of this procedure is percutaneous transhepatic portal venous thrombectomy or just **percutaneous thrombectomy**.

If this is not successful then it may be possible to insert a tube through the clot to keep the vein open using the same guide wire. This is known as percutaneous transhepatic portal venous stenting or just **percutaneous venous stenting.** If stenting is successful then your doctors may decide to

give you long term aspirin (which prevents the platelets that cause a clot from sticking together) or warfarin (which keeps the blood thin).

There is a special way of checking if there is blood flow through the hepatic portal vein using ultrasonic waves (similar to that used by submarines). This test is called **duplex scanning** and is performed in the X-ray department. This is similar to a normal ultrasound examination.

Venous bleeding:

If there is permanent splenic vein thrombosis and/or hepatic portal vein thrombosis then the blood pressure will build up in the tiny vessels that normally drain into these big veins. The tiny veins now become much larger and are called **venous collaterals**. These slowly increase in size over some months or years and become windy or tortuous. These are then referred to as **varices** (similar to varicose veins in the legs, but now inside the abdomen). The varices may appear in the stomach and in the lower gullet. There is a small but real danger that bleeding may occur from rupture of one of these varices. For this reason it is important that you maintain close contact with your consultant in out-patients. From time to time the consultant will organise for you to have an **endoscopy of the gullet and duodenum** to see if the varices have enlarged. If the varices are large then they can injected using the endoscope – this is called **endoscopic sclerotherapy**.

If bleeding does occur you will need to come to hospital as an emergency – usually there is vomiting of blood. In this situation you will have a blood transfusion and a balloon placed in the stomach and gullet to press on the varices to stop them bleeding. You will also be given injections or a continuous infusion of special drugs that will reduce the pressure in the

varices. This will then be followed by endoscopic sclerotherapy. These measures are usually successful.

Very occasionally the bleeding will keep recurring and in this case surgery is required. The operation will involve removal of the spleen and disconnection of the varices from the stomach. This operation is called **gastric devascularisation and splenectomy**. In exceptional cases this procedure will also prove not to be successful in which case you will require removal of the whole stomach (**total gastrectomy**) and connection of the gullet to the small bowel (jejunum). It is common practice to recreate a small 'stomach' from the small bowel called a pouch. This is therefore called a **Roux-en-Y oesophago- pouch-jejunostomy**.

Arterial bleeding:

During the course of severe necrotising pancreatitis about one in fifteen patients will develop some type of bleeding from a small or large artery. This may even occur during skunking – and since you would be awake, this may seem quite alarming. Your doctors are however always prepared for this. If this does occur whether you are in theatre, on the ward, in HDU or in ITU you will be taken immediately to the X-ray department. You will 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 exact place where the bleeding is taking place (this is called **selective**

arteriography). The bleeding will then be stopped by injecting special metal coils and glues into the catheter (this is called **embolisation**). The whole procedure is called **selective arterial embolisation** and is highly successful. Only rarely is it necessary to try to stop the bleeding with **open surgery** and is only performed if the selective arteriography has not identified the source of bleeding or if the selective arterial embolisation has failed.

Colonic necrosis:

On rare occasions in severe necrotising pancreatitis, the pancreatitis spreads into the base of the large bowel (also called the **colon**) and cuts some of its blood supply off altogether. This will cause the death (or necrosis) of that part of the colon – hence **colonic necrosis**. The patient will become very sick and there may be a large amount of bleeding. In this case emergency surgery is needed to remove the dead colon. At the time it may be necessary to avoid joining the bowel ends together. This would be done at a later time when the patient has recovered from the pancreatitis altogether. In this case one or both ends of the bowel are brought out onto the skin as a **colostomy**.

Ascites:

(Pronounced ‘ass-eye-teas’). This refers to the build up of fluid in the abdomen. This sometimes follows hepatic portal vein thrombosis. Because of the pressure in the venous collateral not all of the fluid that should be returned to the liver can be. This fluid therefore accumulates in the abdomen. Normally this will slowly improve but sometimes you will need treatment with a special water tablet (called **spironolactone**) and tablets or injections (using a drug called **octreotide**) to reduce the pressure in the varices and venous collaterals. In addition you may need

to be admitted to hospital to drain the fluid by inserting a tube into the abdomen (usually in the X-ray department) under local anaesthetic. This type of drainage is called an **ascitic tap**. If the ascites is still a problem you may need surgery to drain the fluid from the abdomen into one of the veins in your neck or leg. The fluid then becomes part of the normal blood circulating around the body.

Pancreatic Fistula:

The term 'fistula' is an old medical term meaning an abnormal connection between one surface and another. When there is a connection between the pancreatic duct and the skin this is known as an **external pancreatic fistula**. This happens naturally as part of the treatment of most patients with extensive pancreatic necrosis. Most pancreatic fistulas dry up with no special measures except that the drainage tube is shortened slowly over many weeks before it is finally removed.

Only in exceptional circumstances is it necessary to encourage closure of the fistula by **pancreatic stenting** or the use of **octreotide injections** to reduce pancreatic secretions.

Pseudocyst:

(Pronounced 'Sue-doe-cyst') This is a cystic swelling which lies in the pancreas or next to the pancreas and which contains high concentrations of pancreatic enzymes. Often pseudocysts disappear without any specific treatment. If a pseudocyst remains or enlarges, it may cause nausea, vomiting, pain and weight loss, in which case, treatment is necessary. There are different ways to treat large pseudocysts.

Sometimes it is possible to insert a tube into the pseudocyst under local anaesthetic in the X-ray department and drain the fluid away without surgery. This is called **external drainage** or **percutaneous drainage.** The pseudocyst can be drained internally by **endoscopic stenting** (see above). Often the most appropriate method is by surgery. The operation of **Roux-en-Y pseudocyst-jejunostomy** drains the pseudocyst into a specially created small bowel channel. The operation of **pseudocyst-gastrostomy** drains the pseudocyst into the stomach.

Pancreatic Abscess:

A collection of pus may develop in or near the pancreas during or after an attack of severe pancreatitis. The treatment is usually successful and just requires **external drainage (**or **percutaneous drainage)** with a tube inserted under local anaesthetic in the X-ray department but may occasionally require **open drainage** surgery.

WHAT CAN I EAT?

For a few weeks after an attack of acute pancreatitis you should eat at regular intervals. It is usually better to take four or five snacks a day than a full meal. If you have gallstones, and for some reason your gall bladder has not been removed, avoid fatty foods such as butter, eggs, fried foods, sausages and bacon. Following removal of your gall bladder you are free to eat anything you wish. You will have a very healthy appetite and you may put on more weight than you would otherwise, unless care is taken to avoid excess calories.

If you have had extensive pancreatic necrosis it is likely that you will need pancreas enzyme supplements (see below) and even insulin if you have developed sugar diabetes (see below).

CAN I DRINK ALCOHOL?

Alcohol is not recommended for patients who have **recurrent acute pancreatitis** and should be avoided in patients for whom the **cause of their acute pancreatitis is alcohol**. Alcohol must also be avoided in patients with **idiopathic pancreatitis** or **hereditary pancreatitis**.

If alcohol is not the cause of your acute pancreatitis 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.

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.

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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 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.

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.

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 R Charnley, FRCS,

Secretary, Pancreatic Society of Great Britain and Ireland,

Department of Surgery,

Freeman Hospital,

Newcastle-upon-Tyne, NE7 7DN.

Pancreas Research Fund

Specifically supports basic and clinical research of all diseases of the pancreas. Any cheques should be made payable to the 'University of Liverpool' which administers the Fund.

Write to:

Professor JP Neoptolemos, FRCS,

Department of Surgery,

Royal Liverpool University Hospital,

Daulby Street,

Liverpool, L69 3QA.

Tel: 0151 706 4175

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

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

Pancreatitis Supporters Network

This is a support group which has members throughout the UK. The Network provides information and support to patients with pancreatitis and their relatives. This is a registered charity.

Write to:

Mr. Jim Armour,

Chairman,

Pancreatitis Supporters Network,

PO Box 8938,

Birmingham, B13 9FW.

Tel: 0121 449 0667

MRI Pancreatitis Support Group

Provides support and advice to patients with pancreatitis in the Manchester region.

Write to:

MRI Pancreatitis Support Group,

Pancreato-biliary administrator,

Manchester Royal Infirmary,

Oxford Road,

Manchester, M13 9WL.

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