NHS
The Leeds Teaching Hospitals
NHS Trust

Hydrocephalus and Shunts

Information for patients

Leeds Centre for Neurosciences

What is hydrocephalus?

The brain is surrounded by fluid called CSF - Cerebrospinal fluid. The CSF provides some protection for the brain. The brain makes CSF in special fluid-filled spaces called ventricles. The ventricles link to each other by a system of channels through which the CSF flows and eventually leaves to surround the whole brain and spinal cord. The CSF is then taken back into the bloodstream by special channels beside the major veins on the inside of the skull. These are called arachnoid granulations.

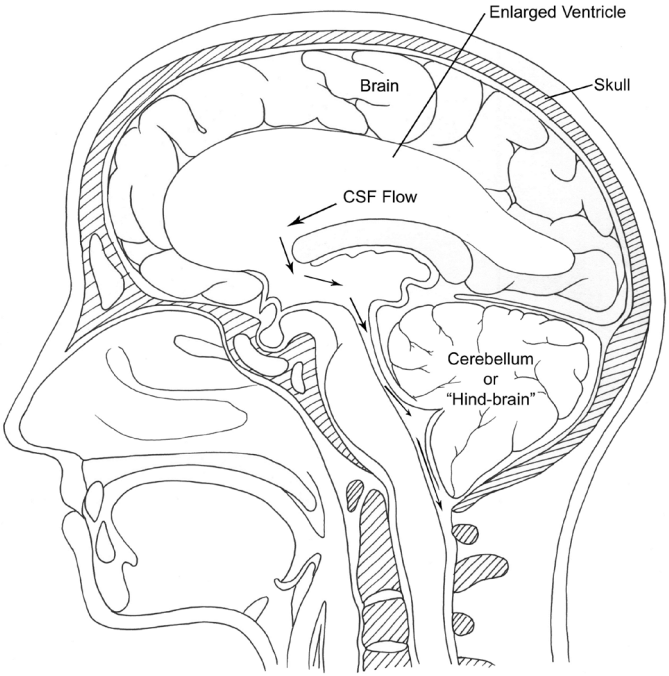

Figure 1 - Diagram of the brain showing normal CSF pathways

Hydrocephalus is a condition in which the CSF builds up within the brain.

There are a number of causes of this:

1. The fluid pathways may be blocked or narrowed so that fluid cannot flow adequately. The causes of this blockage can include scarring, a variation in the development of the fluid pathways (present from birth) or sometimes, by a tumour which blocks the CSF flow.
2. Sometimes, the fluid collection channels (arachnoid granulations) can become blocked and stop working - in a similar manner to how leaves can block a drain. This can happen following an infection or a bleed (haemorrhage).

As a result of this block in fluid flow, CSF builds up inside the brain, resulting in an increase in pressure. As a result of this, patients most commonly report symptoms of headaches, nausea and vomiting but problems with balance and short-term memory have also been reported.

There is another group of patients who do not fit into the patterns described above. These patients have Idiopathic Intracranial Hypertension or Benign Intracranial Hypertension. In this group of people, the underlying cause is not fully understood; however, it leads to a build up in fluid pressure around the brain and spine causing headaches and problems with vision. This is treated in the same way as the other causes of hydrocephalus, with insertion of a shunt.

What investigations are required?

CT brain scan

Normally, a CT brain scan will be performed before shunt insertion. This is a special x-ray based scan which shows us the anatomy of the ventricles and helps us to decide which is the best treatment option. A CT brain scan may also be used in the future if there is a concern that the shunt may have malfunctioned, as it will help us see whether or not the ventricles have enlarged.

MRI brain scan

If more detailed information is required about the anatomy in the brain, an MRI scan can be done. This is a more detailed scan of the brain that involves an extremely strong magnet and does not involve x-rays. It is a noisy scan and the patient has to lie very still during it.

X-ray (Shunt Series)

Usually after a shunt has been inserted, a series of x-rays will be performed to allow the surgeons to assess the continuity of the shunt.

These x-rays will be repeated in the future if there is potential that the shunt may have malfunctioned, as the x-ray allows us to assess whether the shunt may be broken or fractured.

How is hydrocephalus treated?

There are a number of different treatment options for hydrocephalus and the most suitable will depend on a number of factors. All treatments aim to remove or divert CSF from the brain in a controlled manner to relieve the pressure from the brain.

The methods that are most commonly used are:

1. Lumbar Puncture.
2. Lumbar Drain.
3. External-Ventricular Drain (EVD).
4. Insertion of a "Shunt".
5. Endoscopic Third Ventriculostomy (ETV).

1. Lumbar Puncture

A Lumbar Puncture is a medical procedure where a needle is inserted into the lower part of the spine.

A needle is inserted into the base of the spine under local anaesthetic. The needle passes into the spinal canal, the channel running down the spine that contains the spinal cord and the nerves that come off it. The spinal cord actually ends part way down your back so there is space to safely perform a lumbar puncture by putting the needle in below this point.

The pressure within the spinal canal is usually measured, after which some of the CSF is removed. The fluid is removed, either to reduce the pressure or so a sample can be sent to the laboratory for testing.

In most cases, the lumbar puncture is carried out while you are lying on your side with your legs pulled up and your chin tucked in. Alternatively, the procedure may be carried out while you are seated and leaning forwards.

The procedure usually takes around 30 - 45 minutes to complete.

2. Lumbar Drain

A Lumbar Drain is a fine tube that is inserted into the lower part of the spine to drain away excess CSF.

This procedure is normally done under sterile conditions under a local anaesthetic. It is to a lumbar puncture - a needle is inserted into the lower part of the spine. The fine tube is then fed through the needle and the needle is then removed. The tube is left in place normally for 7 - 10 days, although the precise time depends upon the reason for inserting it.

The lumbar drain is then connected to a drainage system. This allows the CSF to be safely drained off. The drainage system settings can be altered by the nursing and medical staff to regulate the amount of CSF that is draining and control the pressure in the head.

Before the lumbar drain is removed, the system can be tested over a couple of days to check this. If the tests show that the drain can be removed safely, it can be safely removed on the ward and a stitch inserted to seal the skin; however, if the tests show that further drainage is required, the drain might be renewed or changed for a shunt (please see pages 9 - 10).

Because the settings of the drainage system relate directly to the head position, it is important that nurses are with patients when they move to ensure any necessary adjustments are made.

3. External-Ventricular Drain (EVD)

An External Ventricular Drain (EVD) is a fine tube that is inserted into the fluid space of the brain (ventricle) by a neurosurgeon.

An EVD is inserted particularly if there is a problem with infection or fresh bleeding in the fluid spaces of the brain. Sometimes, it can also be used to help control pressure after a head injury. Also, it is sometimes put in when there are concerns that a shunt may not be working properly.

The insertion of an External Ventricular Drain (EVD) is a surgical procedure where a fine tube is inserted directly into one of the fluid spaces (ventricles) of the brain. It is usually done in the operating theatre under a general anaesthetic but sometimes can be done under local anaesthetic.

The EVD is then connected to a drainage system. This allows the CSF to be safely drained off. The drainage system settings can be altered by the nursing and medical staff to regulate the amount of CSF that is draining, and control the pressure in the head.

An EVD is a temporary device. When the neurosurgeons feel it may not be required anymore, the system can be tested over a couple of days to check this. If the tests show that the EVD can be removed safely, the EVD is removed on the ward and a stitch inserted to seal the skin; however, if the tests show that further drainage is required, the EVD might be renewed in the operating theatre or changed for a shunt (see next page).

Because the settings of the drainage system relate directly to the head position, it is important that nurses are with patients when they move to ensure any necessary adjustments are made.

4. Insertion of a "Shunt"

A shunt is an internalised system designed to provide continuous drainage of CSF.

The CSF can either be drained away from the ventricles of the brain (ventricular shunt) or from around the spinal cord in the lower back (lumbar shunt). The choice between a ventricular shunt and a lumbar shunt is made according to the reason for the hydrocephalus. Your surgeon will usually make a specific recommendation based upon the relative risks and benefits of each one.

Ventricular Shunts

There are three main types of ventricular shunt used:

- **Ventriculo-Peritoneal (or VP) Shunt** - The CSF is drained into the abdominal cavity where it is taken back into the blood stream.
- **Ventriculo-Atrial (or VA) Shunt** - The CSF is drained directly into one of the blood vessels going to the heart.
- **Ventriculo-Pleural (or V-Pleural) Shunt** - The CSF is drained into the space beside the lung where it is taken back into the blood stream.

The ventricular shunt systems incorporate a valve that regulates the flow of CSF along it. Two types of valve can be used and the choice depends on our expectation about the shunt function. They can either be set at a fixed pressure setting or be special variable valves that means the setting can be adjusted after surgery (using a special magnet against the skin over the valve) to change the amount of CSF drainage.

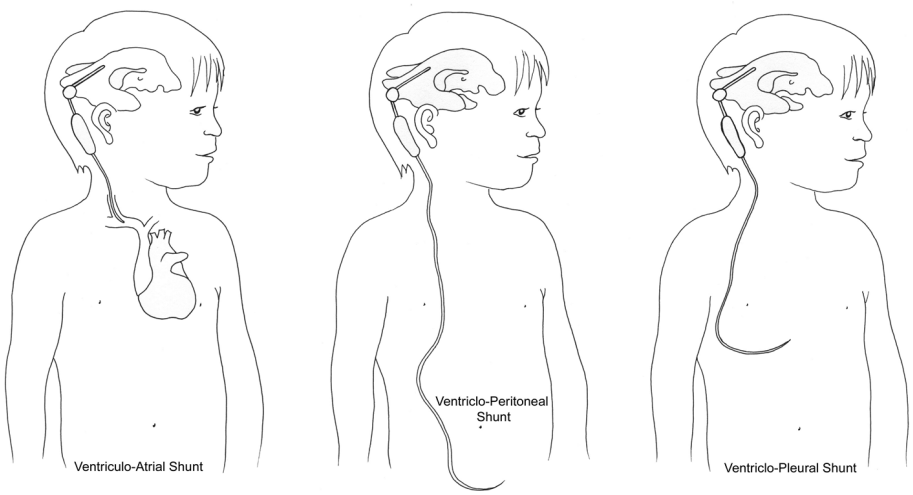

Figure 2: Diagrammatic illustration of the shunt types

Inserting a ventricular shunt involves an operation under general anaesthetic in the operating theatre.

It involves the following stages:

1. Usually two cuts to the skin - one in the head, usually above and behind the ear. The second cut is made in abdomen for a VP shunt, the side of the neck for a VA shunt or the side of the chest for a V-pleural shunt.
2. A hole is made through the skull.
3. The shunt is then tunnelled under the skin between the two cuts.
4. The shunt is then inserted into the ventricle and flow of CSF along it is confirmed, before the other end is inserted and both wounds then closed.

A bump remains visible under the skin surface behind the ear. This is due to the valve which is an essential part of the shunt system. It is approximately 0.5 cm in height, 2 - 3 cm long and 1 cm wide. This will become less visible over time as the hair regrows.

Lumbar Shunts

The lumbar shunt systems involve a tube draining CSF away from around the spinal cord in the lower back. They can drain the fluid to either the abdominal cavity (most common) or beside the lung.

- **Lumbo-Peritoneal (or LP) Shunt** - The CSF is drained into the abdominal cavity where it is taken back into the blood stream.
- **Lumbo-Pleural (or L-Pleural) Shunt** - The CSF is drained into the space beside the lung where it is taken back into the blood stream.

This shunt type tends to drain more fluid when the patient is sitting or standing and less when they lie down. The shunt tube has a special slit-valve mechanism at the end of it. For some patients, additional valves are put into the system to regulate flow.

Inserting a shunt involves an operation under anaesthetic in the operating theatres. It involves the following stages:

1. Two cuts to the skin - one in the lower back over the spine, and the second cut in the abdomen for a LP shunt, or the side of the chest for a L-pleural shunt.
2. A spinal tap is performed through the cut in the back.
3. The shunt tube is passed down through the needle into the fluid space around the spine.

4. The shunt is then tunnelled under the skin to the other cut and flow of CSF along it is confirmed, before the other end is inserted and both wounds then closed.

5. Endoscopic Third Ventriculostomy (ETV)

In some cases of hydrocephalus, the brain's internal fluid channels can get blocked. In these circumstances, it may be possible to make a new exit hole (ventriculostomy) for the CSF to flow out from. The operation is called an endoscopic third ventriculostomy and is done with a special fine telescope tube called an endoscope that allows the neurosurgeon to look inside the ventricles.

The advantage of this operation over a shunt is that it can provide a permanent cure, whereas shunts fail over time and need to be replaced. The decision as to whether or not this operation is possible is made with careful examination of your scans.

It is important to be clear however, that even with a scan that shows this operation may be possible or should work, we cannot guarantee that it will be successful and a shunt may still be required.

The operation involves the following:

1. Under general anaesthetic, a 2 - 3 cm cut is made, usually at the top of the head towards the front, behind the hairline. This is most often on the right but may occasionally be on the left, depending on the scan findings.
2. A hole, 1 - 1.5 cm is made through the skull and the endoscope is inserted.

3. The internal anatomy of the ventricles can now be seen and the neurosurgeon can advance the endoscope to where the ventriculostomy is made under direct vision.
4. Finally, the neurosurgeon checks that the ventriculostomy is fully open before removing the endoscope and finishing the operation.

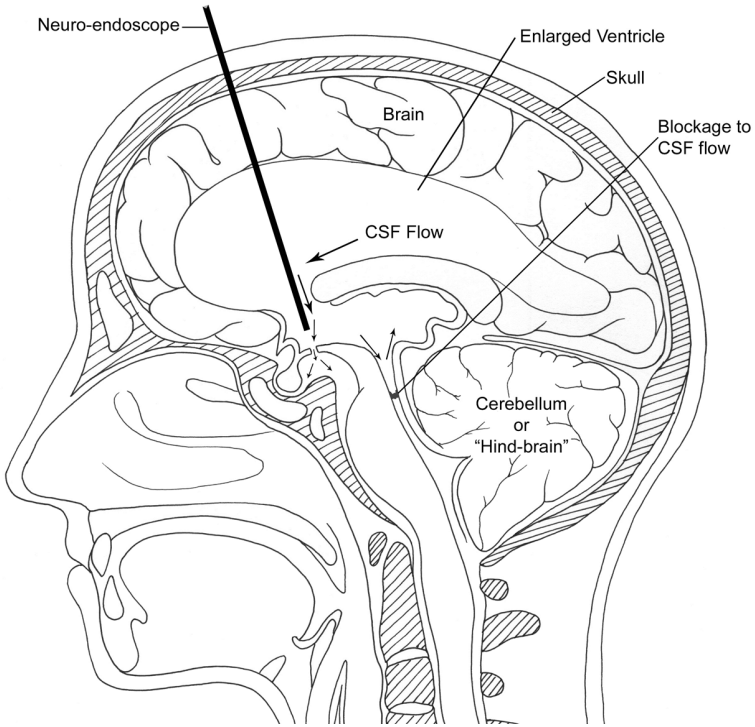

Figure 3: Diagram illustrating a third ventriculostomy with the neuro-endoscope in place and the hole (ventriculostomy) also demonstrated.

Does a shunt last forever?

As a man-made device, a shunt will not last forever. A shunt can last from a few days or weeks to many years. Indeed, in adults we have seen them last as long as 50 years. Over time, the plastic tube can corrode and disintegrate, requiring a new shunt to be inserted. The valve itself can also block and so can the tube that is in the ventricle of the brain itself.

How do I know if the shunt has blocked?

The symptoms of shunt blockage or malfunction vary from person to person, depending on what the initial indication for the shunt was and also how suddenly the shunt blocks. If the blockage is slow, then the symptoms may be seen as slowly progressive.

The most common signs of shunt blockage are as follows:

- headaches;
- nausea and vomiting;
- drowsy, sleepy, hard to wake;
- problems with vision;
- worsening memory;
- balance problems or unsteady on feet;
- worsening concentration or handwriting;
- if epileptic, there may be a change in the number of or pattern of seizures; and
- return of pre-shunt complaints.

If you have concerns, please telephone the Neurosurgery ward and ask to speak to the nurse in charge. **You must ask for the nurse in charge because a less experienced nurse may not understand the importance of your symptoms.**

The ward phone numbers are:

- Ward L24 - **0113 3927424**
- Ward L25 - **0113 3927425**

Alternatively, you can contact the Clinical Nurse Specialist for Hydrocephalus on **0113 3922607**.

Wards L24 and L25 are the Adult Neurosurgical wards at the Leeds General Infirmary. Staff are available 24 hours per day, 365 days per year to receive phone calls and give advice.

We will usually request that you come to the ward for review.

If you are asked to attend the ward, you will usually be reviewed in the first instance by a nurse who will complete an initial assessment and take your observations. You will then be seen by a doctor who will usually further examine you and may organise further tests such as a CT scan, x-rays and a blood test. Once all the information is gathered, a more senior doctor will then make a decision about any further treatment that may be necessary.

When you come to the ward for review, it may be useful to pack an overnight bag, including a supply of any medication that you are taking incase you need to stay in hospital for further observation or even for an operation.

What are the risks of treatment?

Before surgery, the neurosurgeon will go through all the risks with you in detail. The risks of treatment are similar for any neurosurgical operation. What varies is the level of that risk. With this surgery the risks are as follows:

- **Infection** - Due to the skin being cut, there is a risk of infection. This may be a superficial wound infection; however, it may spread deeper and the shunt itself can get infected. This is discussed below.
- **Bleeding / Bruising** - Some bruising may occur around the surgical wound but may also occur along the path of the shunt. There is always some risk of bleeding inside the brain from the operation as well. This risk is small but a blood clot such as this could be potentially serious.
- **Pain** - Some pain may be present along the path of the shunt or from the surgical wounds. This is usually controlled by simple painkillers such as Paracetamol. The operations themselves are not particularly painful procedures.

  Some people may experience headache after a shunt because of a change in the pressure inside their head. This usually settles with fluids, rest and simple painkillers.
- **Brain injury** - The risk of this is extremely small but nevertheless, important to understand. It could be seen in the form of a weakness or paralysis like a stroke and could be temporary or permanent. If something like this were to occur, the neurosurgeon would investigate to find out why it has happened and explain this to you.

- **Fits / Epilepsy** - With any neurosurgical operation, these can occur, simply because an operation has been done. Fits are possible but relatively uncommon after shunt surgery or a third ventriculostomy. Long-term treatment may or may not be required, depending on the circumstances.
- **Risk to Life** - This is usually extremely small but is partially dependent on your age, weight and general health. The risk is there because this is neurosurgery and also, because it involves a general anaesthetic.
- **Driving** - The current DVLA guidance is that **YOU MUST NOT DRIVE** after a ventricular shunt or third ventriculostomy operation. You must inform them that you have been in hospital and had your operation. They will then contact us for details and inform you when you can drive again. The usual time period is 6 months suspension from the date of surgery, provided you do not suffer any epileptic fits.

What happens if the shunt gets infected?

The risk of infection is highest during the first 30 days after surgery.

If the shunt is found to be infected, the system will have to be removed through an operation. During this operation, an external drainage system is often inserted (an EVD, described earlier). This allows the CSF to continue to be drained and also allows antibiotics to be given through it if required. Once the infection has been cleared, a new shunt is inserted.

Other Questions

Can I drive after having the operation?

No. The current DVLA guidance is that you must not drive after a ventricular shunt or third ventriculostomy operation. You must inform them that you have been in hospital and had your operation. They will then contact us for details and inform you when you can drive again.

The usual time period is 6 months suspension from the date of surgery provided you do not suffer any epileptic fits.

Are antibiotics needed for dental treatment?

We do not usually recommend or require this.

Can I fly?

There are no reasons why you should not fly after treatment for hydrocephalus. There are no cases that we know of where this has been harmful; however, if a shunt has been inserted that has an adjustable valve, we usually recommend avoiding electromagnetic scanning devices such as handheld security scanners because they may change the shunt valve setting.

Are there any limitations on sports?

We are keen that people with shunts lead lives that are as normal as possible. All activities and sports pose some risks and so, in theory, nothing is completely safe. We cannot therefore say that anything is completely safe. Someone with a shunt who receives a head injury is potentially more at risk

of harm than a someone without a shunt. Disconnection of the shunt tubing is a small possibility during activities which involve vigorous movements of the head or neck. You should be aware of these slight risks but balance them with benefits of being active and participating in sports.

It is clear that boxing should not be undertaken due to deliberate repetitive head injury. Other activities where the head may be hit deliberately should also be avoided or controlled; for example, we would advise against heading a football and against competitive rugby due to an increased risk of bleeding in / over the brain. We also urge caution with scuba diving diving due to the risk of harm whilst in deep water. Martial arts may be undertaken if head blows are avoided. Swimming should be supervised. An exhaustive list is not possible but we hope this gives some useful guidance.

Will it affect me at work?

The shunt is fully under the skin and as such there is usually only minimal external evidence that it is there. The shunt itself will not affect academic performance or achievement. It is usual to have 2 - 4 weeks off work to recover from shunt surgery.

What if I have a head injury?

Normal post head injury procedures should be followed and you should go to the Emergency department if you have concerns. It would be important to mention to the doctors that you have a shunt as this will help them assess and treat you.

How long is the hospital stay?

You will usually be discharged within 1 - 3 days of surgery. Initially, you will need to plan to have 2 - 4 weeks off work to recover from the operation.

Who should I contact if I have any queries?

If you have concerns, please telephone the Neurosurgery ward and ask to speak to the nurse in charge. **You must ask for the nurse in charge because a less experienced nurse may not understand the importance of your symptoms.**

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When you come to the ward for review, it may be useful to pack an overnight bag, including a supply of any medication that you are taking in case you need to stay in hospital for further observation or even for an operation.

Please bring this booklet with you if asked to attend the ward for review.

Shunt Investigation History

Name	
Date of Birth	
Hospital No.	
NHS No.	
Address	
Consultant	

My Information

Next of Kin	
Phone No.	
GP Name	
GP Address	
Past Medical History	
Allergies	

AFFIX PATIENT LABEL

My Shunt Settings and Diagnosis

The above named person has a:

Ventriculo-Peritoneal / Ventriculo-Atrial / Ventriculo-Pleural / Lumbo-Peritoneal / Lumbo-Pleural shunt

for: ..... (Diagnosis)

Shunt insertion date: .....

Valve manufacturer and serial no: .....

Valve pressure setting: ..... Fixed / Programmable

Usual presentation of blocked shunt:

.....

.....

.....

Any other information:

.....

.....

.....

Shunt Investigation History			
Date:		Time:	
Symtoms:			
Investigations	CT Head	Shunt Series	Shunt-Tap
	ICP Monitoring		
Outcome:	Discharge	Shunt Revision	Valve Setting Change
Seen by:			

Date:		Time:	
Symtoms:			
Investigations	CT Head	Shunt Series	Shunt-Tap
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Outcome:	Discharge	Shunt Revision	Valve Setting Change
Seen by:			

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Seen by:			

For further advice, contact:

Fiona Evans - Hydrocephalus Clinical Nurse Specialist
Tel: **0113 3922607**

Ward L24 - Tel: **0113 3927424**

Ward L25 - Tel: **0113 3927425**

Leeds General Infirmary, Switchboard - Tel: **0113 2432799**

Patient Advice and Liaison Team
Leeds General Infirmary
Great George Street
Leeds, LS1 3EX
Tel: **0113 2067168**
Email: **Patient.relations@leedsth.nhs.uk**

Trust website address: www.leedsteachinghospitals.com
Neurosurgery Dept Website: www.leedsneurosurgery.com

Please keep this booklet safe and bring it with you if asked to attend the ward.

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Developed by: Huw Selley, Hydrocephalus Clinical Nurse Specialist and Mr John Goodden, Consultant Neurosurgeon
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