



Spring-assisted cranioplasty

This information sheet from Great Ormond Street Hospital (GOSH) explains about the spring-assisted cranioplasty operation, which is used to treat craniofacial disorders. It explains how to prepare your child for surgery as well as what to expect in hospital afterwards.

What is a para-sagittal osteotomy with insertion of springs operation?

Spring-assisted cranioplasty is a type of operation used to correct the abnormal head shape seen in children with sagittal craniosynostosis. It involves removing a tiny piece of skull bone, making cuts (osteotomies) either side of the fused sagittal suture and inserting metal springs that gradually widen the gap, which encourages new bone to grow in between the two cut surfaces. It also enlarges the space within the skull to allow the brain to grow and develop.

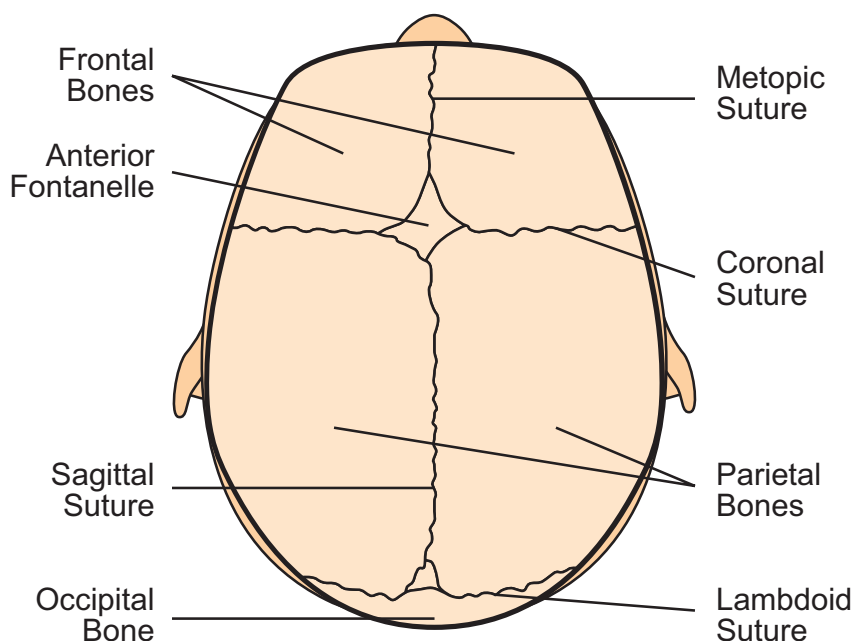
The skull is made up of several 'plates' of bone which, when we are born, are not tightly joined together. The seams where the plates join are called 'sutures'.

As we grow older, the sutures gradually fuse (stick) together, usually after all head growth has finished. When a child has craniosynostosis, the sutures fuse before birth. It can affect one suture or several.

When one or more sutures fuse too soon, the space inside the skull cannot expand as a child grows. This has the potential to put pressure on the brain (intracranial pressure) which can have significant long term effects.

Spring-assisted cranioplasty is ideally carried out at the age of four to six months, while the skull bones are more pliable so respond better to treatment but is still possible up to the age of eight months. A second shorter operation will be needed to remove the springs. Children with sagittal craniosynostosis may benefit from this operation.

Normal Skull of the Newborn



What happens before the operation?

Pre-admission clinic

Preparing for a planned operation, test or procedure before coming in to hospital avoids delays and reduces the risk of cancellation.



The results of any tests and investigations are available in plenty of time and can also be re-checked if they are not within the normal range. Your child may need various blood tests before the operation – this depends on your child's medical condition and the nature of the surgery that is planned.

The doctors and/or nurses will meet you and your child to take down their medical history and any other information needed before your child is admitted to hospital. The nurses will explain about any care your child will need before and after the operation. If your child has any medical problems, particularly allergies, please tell the doctors about these. Please also bring in any medicines your child is currently taking.

You may be seen by one of the team carrying out your child's operation and be asked to give permission for the procedure by signing a consent form. If you give your consent at the pre-admission appointment, you will need to confirm that you still agree to the procedure on the day of admission.

One of the team will explain about the types of anaesthesia that are used at the hospital, and also about options for pain relief after the operation, test or procedure. If there are any questions or concerns about your child's anaesthesia, an anaesthetist may come to see your child in the pre-admission clinic.

The night before surgery

You will be asked to give your child a bath or shower and hairwash before surgery.

It is important that your child does not eat or drink anything for a few hours before the operation. This is called 'fasting' or 'nil by mouth'. Fasting reduces the risk of stomach contents entering the lungs during and after the procedure.

You will be informed the night before the procedure of the time that your child should be 'nil by mouth' – in other words, have nothing to eat or drink before the anaesthetic. In broad terms, this is six hours for food (including milk), four hours for breast feeding and two hours for clear fluids before the procedure.

It is equally important to keep giving your child food and drink until those times to ensure they remain well-hydrated and get adequate nutrition. This may involve waking your child in the night to give them a drink which we recommend.

On the day of surgery

Please come to Woodpecker at the time stated in your admission letter. One of the nurses will check that your child is well enough for the operation, complete some paperwork with you and take some baseline observations of their temperature, heart rate and breathing. They will also put an identification wristband on your child.

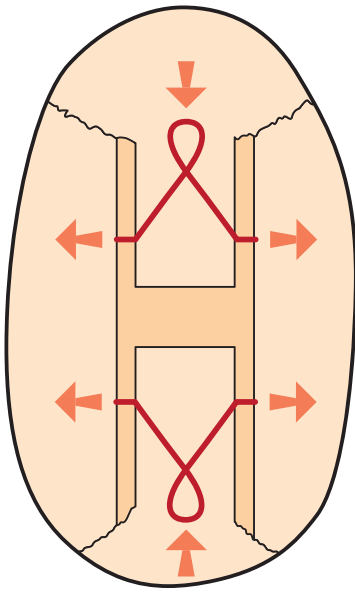
If you did not give your consent for the operation at the pre-admission appointment, a member of the surgical team will visit you to explain about the operation and ask you to sign a consent form. All children are seen by the anaesthetist on the day of the operation.

What anaesthetic is given?

Your child will be given a general anaesthetic by an anaesthetist who specialises in giving anaesthetics to babies and children. Both parents will be able to go with your child to the anaesthetic room and stay until they are asleep. This usually involves your child breathing some anaesthetic gas. Later, a tube is passed into the airway (trachea) to safeguard breathing. A cannula (thin, plastic tube) is put in a vein and usually left in place for a short time after the operation. Fluids can be given to your child through this tube during the operation and afterwards if necessary.

What does the operation involve?

The spring-assisted cranioplasty operation is carried out while your child is under general anaesthetic. When your child is under general anaesthetic, the surgeon will clip your child's hair just over the incision site and fix the rest of their hair out of the way. They will make



an incision about 8 to 10cm long over the top of your child's head to expose the skull and hold the skin out of the way with clamps.

Next, the surgeon will cut through the fused sagittal suture and remove a portion. The osteotomies are then made, leaving a small gap between the cut surfaces of the bone. Two metal springs will be fixed either side of this gap so that over the next few weeks, the springs open out to widen the gap. New bone forms in the gap over the coming months. The skin is then closed over the incision site

and held in place with dissolvable stitches.

Children have a drain inserted which will be left in place to drain off any fluid that collects after surgery – this will be removed the following day. Finally, the surgeon will put a head bandage over the operation site. Your child will then be taken to the Recovery area to start to wake from the anaesthetic.

Are there any risks?

Healthy children usually cope well with the anaesthetic, but the risk increases if your child has other problems.

All surgery carries a small risk of infection or bleeding. To reduce the risk of infection, your child will be given a dose of antibiotics during and after the operation.

Your child will be monitored very closely during and after the operation to identify any blood loss. A blood transfusion is required only in a minority of cases.

This surgery requires separating the skull bone from the protective layer covering the brain (the dura), a process which can, in a tiny proportion of cases, cause brain injury or bleeding inside. Therefore, any craniofacial operation carries a very small chance of causing serious complications such as seizures (fits) or stroke (brain damage), which may in some very rare cases be life-threatening. The overall risk of a major neurological event or

death is much less than one per cent (less than a 1 in 100 chance).

Sometimes small holes can be made in the dura during the operation, which do not pose any risk to the brain, but which can occasionally be the source of a leak of cerebro-spinal fluid (CSF; a clear, watery fluid that surrounds and cushions the brain). The surgeons usually identify and repair (stitch) any holes during the operation. Despite this, sometimes children develop a CSF leak after surgery, which may show up as a fluid-filled swelling at the operation site or a leak of clear, watery fluid from the wound. It will be explained to you what to do if you notice these problems after discharge from hospital, as sometimes further procedures may become necessary to stop the leakage if one occurs.

Your child's head and face may look swollen and bruised after the operation. The nurses will check your child's head bandage every few hours and re-apply it if it is getting tight. A degree of swelling is likely to persist for several weeks but will improve in time.

The incision site will start to heal and will eventually fade until it can hardly be seen. The hair will also start to re-grow in the days following surgery.

Spring insertion carries some specific risks, such as failure or dislodgement of the springs. The springs are made within the hospital by our Biomedical Engineering department and tested thoroughly to ensure that they are strong enough to give the desired result. Failure or dislodgement will not usually be harmful but could mean that the operation needs to be repeated. Very rarely, the skin over the springs starts to break down rather than heal. The nurses will explain what signs to look out for that might indicate an infection or other problem with the wound.

You may notice that ridges appear to develop over the coronal sutures. This is a side effect of the springs widening the sagittal suture and is only temporary. The ridges gradually become less prominent over the year following surgery as your child grows.



Are there any alternatives to this operation?

One alternative to this surgery is not to operate at all. Unless your child has clinical evidence of raised intracranial pressure (which will be assessed by the craniofacial team) it is entirely reasonable not to operate on single-suture synostosis. The view of the craniofacial team at GOSH is that surgery for single suture synostosis, in the absence of evidence of raised pressure, does not bring benefits other than correction of the deformed head shape.

There are many different operations done around the world for sagittal synostosis, and unfortunately there is little useful scientific evidence to show that one type of operation is superior to another. Therefore, GOSH, like other craniofacial units around the world, offers surgery that we know, that in our hands, offers good correction of head shape and is safe.

Operations for sagittal synostosis can be broadly divided into two types.

Firstly, there are suturectomy-based operations, based around opening the closed suture and using some form of distraction to passively reshape the head. Examples include spring-assisted cranioplasty and endoscopic suturectomy with helmeting. These operations are usually only effective in small babies where the skull is still 'elastic' and can be passively reshaped. In general, the advantage of these operations is that the skin incision and bony cuts are less extensive, leading to a shorter hospital stay, faster recovery and lower transfusion rates. The downside is that they rely on passive alteration of the skull growth, which means results can be less predictable – that is, some children do not get a full correction and require further surgery. From our series, for example, we estimate about 5 per cent of children who have spring-assisted cranioplasty may require another operation for appearance reasons.

Secondly, there are vault-remodelling operations. These involve a longer scar to expose the skull bones more fully, and usually multiple bone cuts and reshaping to achieve the desired shape. No springs, helmets or

other distraction devices are used. These operations can be done at any age (up to adulthood) as they do not rely on passive reshaping. Examples include total calvarial remodelling, sagittal craniectomy with barrel-staving, anterior two-thirds remodelling and others. The advantage of these operations is that they offer a very predictable and stable result – the surgeon actively 'remodels' the head to the desired shape rather than relying on passive reshaping. The downside is that these operations take longer to do, require a longer scar to fully expose the skull bones and have a higher transfusion rate.

The risk of very serious complications, such as injury to the brain is low (less than one per cent) for both suturectomy-based and vault-remodelling operations.

What happens after the operation?

Once your child has started to recover from the anaesthetic, they will be brought back to Koala Ward to continue recovering. At the end of the day, the doctors will visit you to talk about the operation.

The nurses will carry out regular observations of your child's breathing, heart rate and temperature throughout the rest of the day and night. They will also check your child's head bandage and re-apply it if it is getting tight. Your child should sit and lie in as upright position as possible to reduce any swelling.

Your child may feel sick after the operation, but the doctors will give them medicines to reduce this. The sickness should pass within a couple of days. Your child will be able to start eating and drinking as soon as they feel like it.

The nurses will also assess your child's pain and give them regular pain relief – intravenously to start with and then by mouth when they are eating and drinking.

The day after the operation, the nurses will remove your child's head bandage and drain if one was in place. Your child will have a skull x-ray to check the position of the springs and as a baseline to monitor their expansion.



Going home

When your child is recovering well, eating and drinking as normal and the x-ray has been reviewed, you and your child will be able to go home, usually the following day. The nurses will also give you a copy of our discharge information which explains how to look after your child and what signs to look out for over the next few weeks. You should wash your child's hair gently with a mild shampoo three days after the operation. The stitches are dissolvable so will gradually break down and fall out over the next few weeks.

Follow up appointments

Three weeks after the operation, your child will have an appointment with an x-ray to check the results of surgery – we will give you details about the appointment before you go home.

Removal of springs

Your child will need to come back to GOSH after the operation to have the springs removed. There is no strict rule of timing for removal – it is decided on an individual patient basis. On average, spring removal is performed around three months after the first operation. This involves a short operation under general anaesthetic lasting about an hour. The surgeon will open the incision made during the first operation and gently remove the springs, checking formation of new bone tissue while they do this. They will then close the incision using dissolvable stitches as before. Your child will be able to go home as soon as they have recovered from the anaesthetic, usually the same day.

What is the outlook for children who have had a spring-assisted cranioplasty?

The outlook for children with sagittal craniosynostosis is good with the vast majority growing up to lead a normal life. This operation is a head-shape changing operation rather than one to improve function. The results of surgery are variable but overall most parents are happy with the results. If there is any residual skull deformity, further surgery (vault remodelling) can be performed at a later time. There is no time limit on this surgery. With input from a speech and language therapist any initial delays in speech development improve with no lasting effects. Raised intracranial pressure can be treated if it occurs. Children are of normal intelligence so usually do well at school, college and university.

Further information and support

Headlines – the Craniofacial Support Group – is the main support organisation in the UK for families of children and young people affected by a craniofacial disorder. Visit their website at www.headlines.org.uk.

If you have any questions, please telephone the Craniofacial Clinical Nurse Specialists on 07768 526 449 (Monday to Thursday from 9am to 5pm). Out of hours, call Koala Ward on 020 7829 8826.

You can also seek medical advice out of hours by telephoning the GOSH switchboard on 020 7405 9200 and asking them to page the craniofacial doctor on call.