

<i>Title</i>	<b>Broviac Lines for Central Venous Access A Guide for Neonatal Staff</b>
<i>Person Responsible for Review:</i>	<i>Mr S. Arul (Consultant Surgeon BCH)</i>
<i>Date Guideline Agreed:</i>	<i>January 2012</i>
<i>Date of Implementation:</i>	<i>March 2012</i>
<i>Date of review:</i>	<i>February 2014</i>
<i>Version no.</i>	<i>SWMNN – draft 1</i>
<i>Related guidelines/policies:</i>	

**Introduction :**

Central venous access is often required during the care of sick and preterm babies. The main reason for long term central access is to give parenteral nutrition.

This is most often achieved using peripherally inserted central catheters (PICC lines). These have the advantage that they can be inserted on the neonatal unit without the need for an anaesthetic, do not usually lead to major vein occlusion and are easy for the nursing staff to remove. The disadvantages are that the lumen is small, they cannot aspirate and can easily block if infusions are not continually running.

PICC lines can sometimes be challenging to insert and there are some babies in whom access becomes so difficult that a surgically inserted ‘Broviac line’ is the only option. These should only be considered when a baby has a definite reason for long-term central venous access (3-4 weeks) and when all sites for PICC line insertion have been exhausted.

Broviac Lines are silastic central lines that are tunneled from the skin of the chest wall with a Dacron cuff inserted about 1 cm from the skin edge. This cuff promotes fibroblast ingrowth and thus anchors the line firmly to the body and also prevents skin organisms from creeping up the line from the exit site. They are inserted under general anaesthetic at Birmingham Childrens Hospital. Broviac lines and Hickman lines are essentially the same and so this paper will refer to all tunneled Silastic lines as Broviac lines.

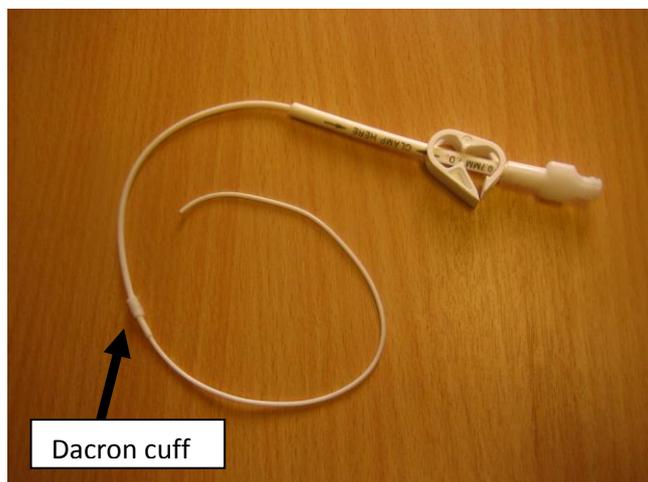


Fig 1. A Broviac Line

Although the surgeon undertaking the procedure should gain parental consent prior to the operation, best practice dictates that parents should understand all the implications of the procedure before agreeing for their baby to be transferred to BCH for the procedure.

It is therefore essential that Neonatal teams have a good understanding of the implications of Broviac line insertion, care and removal so that they can have detailed discussions with parents when a surgically inserted line is being considered for their baby.

**Broviac line insertion :**

Insertion of a Broviac line should only be considered when a baby has a definite reason for long-term central venous access (3-4 weeks) and when all sites for PICC line insertion have been exhausted.

All Broviac lines are inserted under general anaesthetic in the operating theatre at BCH. The majority are inserted by an ultrasound guided percutaneous approach, though some are still inserted via an open cutdown on the internal jugular vein.

Broviac lines will not be inserted in a patient who is pyrexial as the chance of the new line being immediately colonized is very high. These patients need removal of any other lines i.e. PICC lines and antibiotics till afebrile for at least 48 hours prior to insertion.

**The Consent Process:**

The Neonatal team must weigh up the risks and benefits of the line and discuss these with the parents before any arrangements are made with the surgeons. They must therefore have a working understanding of Broviac lines. These discussions must be documented in the notes.

Whilst speaking to the parents, inform them that the surgeon inserting the line will meet with them at BCH before the procedure to discuss any concerns they may have and complete the formal consent form. Occasionally the parents will not be able to attend BCH on the day of the procedure, in this case formal 'Delegated Consent' must be gained by the Neonatal team. In this situation the completed consent form must accompany the baby to BCH with a copy filed in the notes.

The following complications must be mentioned by the neonatal team when speaking to parents about Broviac lines.

- i. Infection
  - ii. Bleeding / bruising
  - iii. Line dislodgement / break / blockage
  - iv. Wound problems (especially for vascuports)
  - v. Pneumothorax
  - vi. Haemothorax
  - vii. Pericardial effusion
  - viii. Cardiac arrhythmias
- } *these are all very uncommon*  
 } *(i.e. no haemo or pneumothorax, 1 pericardial effusion, 3 cardiac arrhythmias in over 1000 patients)*

Complications of insertion	Problems in established lines	Causes of line blockage Difficult to aspirate and flush
<b>Pneumothorax</b>	<b>Infection</b> <i>line, cuff, skin or endocarditis</i>	<b>Tip of line inserted in wrong place</b>
<b>Haemothorax</b>	<b>Breaking</b>	<b>Lumen blocked</b> <i>blood clot or PN / drug concretion</i>
<b>Bleeding / Haematoma</b>	<b>Blockage</b>	<b>Fibrin sheath over end of line</b>
<b>Cardiac Tamponade</b>	<b>Fallout</b>	<b>Thrombus at the line of line</b> <i>blood clot or vegetations</i>
<b>Malposition</b>	<b>Thrombus on tip of line</b>	<b>Line tip pressed against vessel wall,</b> <i>heart valve, atrial wall</i>
<b>Extravasation</b>	<b>Venous occlusion</b>	<b>Line partially pulled out</b> <i>so tip no longer in vessel</i>
<b>Venous Occlusion</b>		<b>Tip eroded through vessel wall</b> <i>and lying outside lumen</i>
		<b>Damage to the line or its lumen</b>

If parents require further information, you might explain the following :

- b. The vascular access team is made up of 5 consultants (2 surgeons and 3 anaesthetists) and is responsible for inserting about 300 central lines per year and that we have one of the biggest experiences for inserting central lines in tiny babies.
- c. The technique used is exclusively the 'ultrasound guided percutaneous approach'
- d. Our operative complication rate has been published as 2.4%
- e. Our line infection rate has been published as 3.16 catheter related infections per 1000 catheter days which is in the same range as other published data from similar centres
- f. There have been no deaths or chest drains inserted for complications of surgery in the last 4 years. Blood transfusions due to bleeding as a complication of surgery are very rarely required and usually occur due to the patients underlying condition that is making them anaemic or affecting their clotting.
- g. No tunnelled central line is done after 6 pm or at weekends so if there is a delay to the list (especially emergencies) we will rebook the child for the next day.

#### **Booking a patient for Broviac line insertion:**

Most patients need their new Broviac line urgently so the booking should be made to the on-call RSO at BCH. If a patient has an elective need for line insertion then the referral can be made directly to Mr Arul either via his registrar or secretary. Arrangements will be made on an individual basis depending on the patient, the degree of urgency and their other clinical needs.

- Details of the discussions with the parents on the need for Broviac line insertion to be documented in the local hospital notes – including the risks to the baby.
- Once a date is set for the procedure, liaise with the Transport team to give them as much notice as possible. Advise parents they will need to travel to BCH on the day of surgery to meet with surgeon to complete consent form at BCH
- If the parents are unable to travel to BCH consent must be taken at the local hospital and a copy of the Consent Form sent with the baby
- On the day of transfer ensure a Transfer Letter for the surgeons is ready to accompany the baby. Ensure the results of a recent FBC, Clotting screen and U&E are included
- Liaise with the transport team and surgical ward again and prepare the baby for transfer so delays are kept to a minimum. Follow instructions from the surgical team with regards to fasting of the patient preoperatively.

#### **Post-Operative care:**

Most patients will return to either the Neonatal Surgical Ward or the intensive care ward though a small number will be done as a drive thru procedure.

- All lines will be imaged in theatre and so can be used immediately unless otherwise specified
- The line will be looped on the chest under an i.v. 3000 dressing +/- a biopatch.
- Use of the Biopatch is restricted to gestational age >26 weeks and postnatal age >7 days
- Avoid excessive pressure over the patch as this can cause pressure necrosis of the skin
- These dressings are changed once a week for three weeks
- See specific nursing SOP for the management of the dressings
- 2.7 Fr lines must have a continuous infusion of fluid at a minimum rate of 2ml/hr to prevent blockage
- 4.2 Fr lines should be heparin locked with heparin (100 IU/ml) when not in use. Heparin (100 IU/ml) should be prescribed and the line should be heparin locked twice a week with 0.4 ml of heparin using aseptic technique. The catheter should be clamped immediately following the instillation of heparin into the lumen of the line. In order to use a line which is heparin locked, the lumen should be aspirated until blood is withdrawn. The aspirated solution should be discarded.

### **Removal of Broviac lines :**

The Neonatal Consultant supervising the care of the baby is responsible for the decision to remove the line, although this may often be made following discussion with the surgeons.

Broviac lines should be removed when:

- The line is no longer needed
- If the line is blocked or damaged
- If the cuff is dislodged so that it is visible outside the skin
- There is evidence of infection in the central line, not controlled by antibiotics
- There is evidence of sepsis with no obvious cause, not controlled by antibiotics
- There are repeated (more than 2) episodes of Broviac line related sepsis

Many babies requiring Broviac lines have chronic lung disease so it is preferable to remove them under local anaesthetic. These will usually be done at BCH, either on the neonatal surgical ward or in theatres. When the outreach surgeon is in place, these may be done at BWH.

### **Preparations for Removal :**

A detailed discussion about the benefits and risks of line removal must be undertaken with with the parents. Document this discussion in the notes. Tell them the surgeon will also discuss the procedure with them just prior to the operation at BCH..

Most Broviac line removals are performed on an elective basis. Referrals should be made directly to Mr Arul, either via his Registrar or Secretary, or via the RSO on-call. Arrangements will be made on an individual basis depending on the patient, the degree of urgency and their other clinical needs.

Once a date is agreed inform the transport team. This will enable them to plan their workload ahead of time.

On the day of transfer ensure a Transfer Letter to the surgeons is ready to accompany the baby. Ensure the results of a recent FBC and U&E are available as well as a Clotting screen, if suspicious.

Liaise with the transport team and surgical ward again and prepare the baby for transfer so delays are kept to a minimum. Follow instructions from the surgical team with regards to fasting of the patient preoperatively, this is usually the same as for a procedure under general anaesthetic.

### **The procedure involves :**

- Line removal is done under local anaesthetic
- The baby is closely monitored during the procedure
- Dressings are removed and the area cleaned
- Local anaesthetic injection of around the cuff site
- The cuff is dissected out and removed together with the line tip
- Pressure is applied on the neck to prevent a haematoma
- The wound is closed with steristrips and a mepore
- The tip is sent to microbiology for culture
- A scar will always form over the chest exit site

### **Complications to mention include :**

- Bleeding – usually just ooze from the exit site and settles with a bit of pressure
- Infection
- Line breaking during removal (embolisation) – very rare but may require another procedure to remove the line tip
- Wound problems

**Please inform Mr Arul or his secretary if a line falls out or has to be removed prematurely as a result of infection or any other reason if not at BCH. This information is important for the purpose of audit.**

### **Embolised Lines :**

Embolisation of the line tip is very rare but occasionally a line will break causing the tip to embolise into the right atrium or pulmonary artery. If a line stops working then a Chest x-ray should always be done to check for this. Though appearing dramatic there is little immediate danger and thus no need for panic. These lines need to be retrieved by the interventional cardiologists at BCH using a catheter inserted via the groin. Arrangements for this should be made by liaising with either the on-call RSO or the vascular access team.

### **5.0 Useful Information – *click for internet links***

- [Information about the Neonatal Surgical Unit at Birmingham Children's](#)
- [How to get to Birmingham Children's Hospital](#)

## Appendix 1

### Checklist

#### Procedure for transferring patients requiring a Broviac line

*Please tick and initial*

Detailed discussion between the Neonatologist and the parents <i>- details of procedure as well as risks &amp; benefits documented in Hospital notes</i>			<input type="checkbox"/>	_____
Parents able to travel with baby to meet with surgeons to give consent at BCH			<input type="checkbox"/>	_____
If parents unable to travel to BCH Consent <b>MUST</b> be taken at the local hospital and the form sent with child			<input type="checkbox"/>	_____
Date of Procedure confirmed			<input type="checkbox"/>	_____
Transport arranged for transfer			<input type="checkbox"/>	_____
Results of a recent FBC, U&E and Clotting screen available			<input type="checkbox"/>	_____
Transfer letter including all current details <i>- and consent form if completed locally</i>			<input type="checkbox"/>	_____
Baby assessed as medically fit for transfer and Procedure			<input type="checkbox"/>	_____
Baby prepared for transfer Prior to Transfer team arrival			<input type="checkbox"/>	_____
Form completed				
<b>Date</b>	<b>Signature</b>	<b>Print Name</b>		

## Appendix 2

### Different Lines and Indications

#### TUNNELLED CUFFED LINES

##### BROVIAC Line

Definition: This covers all previous terms for tunnelled, cuffed, silicone long term lines.  
Can be single, double or triple lumen, size from 2.7Fr to 10 Fr

Indications: Long term venous access (>3 weeks).

- TPN
- Antibiotics
- Regular blood products
- Toxic chemotherapy

Precautions : Can be damaged if the child is not careful  
If infected need to go to theatre for removal  
Requires a GA for insertion, takes approximately 30 minutes of surgical time  
Can damage the long term patency of the central veins

#### TEMPORARY LINES (NON TUNNELLED NON CUFFED)

##### Temporary Central lines

Definition: All central lines that are inserted percutaneously but without tunnel or a cuff  
Line is inserted directly into a central vein ie internal jugular, subclavian or femoral

Indications: Regular & frequent venous access for 5 days to 2 weeks  
Central monitoring of pressures  
Short term requirement of central access i.e. inotropes, toxic chemotherapy  
Good if the child is prone to sepsis because the line can be quickly removed

Precautions: Only last about 2 weeks before they become infected and block  
A tendency occurs to treat them less rigorously than Hickman lines  
Can damage the long term patency of the central veins especially if inserted blindly

##### Peripherally Inserted Central Catheters (PICC) lines (Long lines)

Definition: Peripherally inserted percutaneous line  
Narrow gauge (24G) The tip lies in a large vein.  
Can be inserted on the ward without a general anaesthetic.

Indications: Moderate length use (up to 2 months)  
Especially good for TPN  
Easy to remove if signs of infection  
Usually doesn't affect the patency of the central veins  
Avoids the need (and thus the costs) of going to theatre

Precautions: Technically difficult to insert  
Very narrow gauge and long length mean they are not good for volume replacement  
Infection rates relate to the number of time these lines are accessed  
Narrow gauge means infusion must be continuous

## References

1. **Ultrasound-Guided Percutaneous insertion of 2.7Fr tunnelled Broviac lines in neonates and small infants.** GS Arul, H Livingstone, P Bromley, J Bennett. *Paediatric Surgery International*, (2010); *in press*
2. **Can a Vascular Access Service reduce out of hours activity?** J Wells, W Jawaid, J Bennett, P Bromley, GS Arul, *Journal of Paediatric Surgery*, (2010); 45: 419-421.
3. **Ultrasound guided percutaneous insertion of Hickman lines. Prospective study of 500 consecutive procedures.** GS Arul, N Lewis, P Bromley, J Bennett. *Journal of Paediatric Surgery*, (2009); 44: 1371-1376.
4. **Local Reactions to a Chlorhexidine Gluconate-Impregnated Antimicrobial Dressing in Very Low birth Weight Infants.** JS Garland et al *The Pediatric Infectious Diseases Journal* (1996);15(10):912-914
5. **BCH CVC Working Group 2006. Guideline for the insertion, maintenance and removal of central venous catheters.**
6. **BCH Intravenous policy 2008**