A nursing approach to caring for a baby and their family undergoing ventricular lavage for post haemorrhagic ventricular dilatation

Ventricular lavage is a treatment that aims to reduce pressure and oedema in the brain, by washing as much blood and harmful substances caused by post haemorrhagic ventricular dilatation (PHVD) as possible out of the brain. The authors discuss the history of the DRIFT trial, which led to ventricular lavage, along with information on the nursing roles and responsibilities of caring for an infant undergoing treatment.

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Key points
1. The DRIFT trial showed that washing blood and harmful substances caused by PHVD out of the brain can significantly reduce cognitive disability in infants at two years of age.
2. DRIFT also known as ventricular lavage is a highly complex procedure that requires training and nursing care on a 1:1 basis throughout treatment.
3. More research is required for NICE to consider ventricular lavage as a treatment recommendation for the NHS.
centres would know how much the treatment would cost them. Ventricular lavage replaced the name DRIFT because human recombinant tissue plasminogen activator (rTPA) (Actilyse, Boehringer Ingelheim International GmbH, Ingelheim, Germany) was not used in the standard ventricular lavage treatment initially, as had been the case in the DRIFT trial, due to its possible association with secondary bleeding. rTPA is a thrombolytic agent which degrades fibrin, and so breaks up thrombi (blood clots). However, as more babies have been treated, rTPA was found to be essential to enable thrombolytic breakdown, ensuring greater clearance by ventricular lavage of any thrombi, thus enabling maximum efficiency of treatment. Due to this finding the use of rTPA has become standard practice in ventricular lavage over recent months. To December 2011 Southmead hospital has carried out ventricular lavage on 16 infants.

Preparation for treatment

Once the infant has been found to be eligible for treatment (see FIGURE 1) and prior to treatment commencing, it is the nurse’s responsibility to ensure that the parents have the opportunity to discuss this treatment with medical staff, and that they have been provided with an information leaflet. It is essential that parents are able to make an informed decision and be involved in all aspects of the care of their baby. Once the parents have decided to go ahead with treatment it is a legal requirement that they sign a consent form in the presence of the neurosurgeon who will be carrying out the surgery to insert the catheters. Consent is only valid when the information provided has been understood by the parents, and the reason for intervention is explained, along with the possible risks/side effects, and an explanation of the implication of refusing consent is given.

On the day of the insertion of the catheters, and for the remainder of treatment, nursing care of the baby undergoing ventricular lavage must always be done on a 1:1 basis. It is the responsibility of the nurse to ensure that all the equipment required to perform ventricular lavage is available. A nursing checklist has been devised to ensure that nursing staff are aware of exactly what is necessary for the treatment to go ahead. Prior to treatment the nursing and medical team must ensure that the infant’s platelets and clotting factors are within acceptable limits, and a dose of vitamin K must be given if the infant has not had a dose within the last week.

The infant must then be transferred into an open incubator and intubated (if not already), several hours prior to the insertion of the drains to allow the infant to stabilise. Prior to the surgeon inserting the catheters for treatment the infant must be sedated, paralysed and given pain relief. This is achieved by the administration of morphine (400µg/kg), and pancuronium (100µg/kg), along with an infusion of up to 40µg/kg/hr of morphine, to make sure the infant remains comfortable throughout catheter insertion.

Once the infant is adequately sedated and paralysed it is important that a blood gas is taken within 30 minutes to ensure that the PCO₂ and pH are within the acceptable ranges before the neurosurgeon arrives, to ensure that the optimum ventilation is achieved during paralysis. It is sometimes necessary to give the infant a further 100µg/kg of pancuronium immediately prior to the insertion of the catheters to ensure that the infant remains paralysed, however this is very much on an individual basis. It is therefore essential that there is a doctor available at all times, just before and during the procedure, so that any additional pain relief/sedation can be prescribed and administered.

Once the medical and nursing team is confident that the infant’s condition is stable and there is adequate sedation, pain relief and paralysis, all unnecessary people in the intensive care unit are asked to leave, so that the procedure can be carried out as a sterile/aseptic procedure and with minimal disruption. The nurse caring for the infant places screens around the cot space to ensure privacy at all times.

Catheter insertion

The surgeon commences by shaving the infant’s hair from the right frontal area to the fontanelle and over the left lambdoid suture. This area is cleaned thoroughly and a local anaesthetic (0.5% or more dilute lignocaine in adrenaline) is injected around the area of drain insertion. The neurosurgeon then makes a very small hole in the skin with a scalpel blade and inserts an arterial dilator to a pre-estimated depth, deciding by reviewing the infant’s routine cranial ultrasounds performed prior to treatment. A Scott ventricular cannula is inserted into one of the lateral ventricles anterially until CSF comes out, then it is secured with a suture and covered with a clear dressing applied to form a seal. Two three-way taps are attached to the end of the catheter. The procedure is then repeated into the opposite lateral ventricle, but positioned posteriorly so that there is an anterior and a posterior drain (see FIGURE 2). The position of the catheters has been standardised regardless of where the IVH has occurred, or if multiple IVHs are present. Pressure changes within the ventricles during treatment further facilitate movement of CSF across the ventricles, therefore ensuring ventricular lavage is achieved. Throughout the procedure it is essential that the nurse monitors the infant’s vital signs, and if the infant shows any signs of being uncomfortable, a further bolus of morphine can be given.

ventricular lavage inclusion criteria

- Intraventricular haemorrhage documented on ultrasound.
- Age less than 28 days
- Progressive dilatation of the each lateral ventricle defined as:
  a) Ventricular width 4mm over the 97th centile of Levene
  OR
  ALL THREE OF THE FOLLOWING:
  a) Anterior horn diagonal width 4mm (1mm over 97th centile of Davies)
  b) Thalamo-occipital distance 26mm (2mm over 97th centile of Davies)
  c) Third ventricle width 3mm (1mm over 97th centile of Davies)
- Measurements above one of the above criteria on one side combined with obvious midline shift indicating a pressure effect.

Exclusion criteria

Generalised bleeding tendency:
- PT >20 seconds
- APTT >50 seconds
- Platelets <50x10⁹/L

An infant may become eligible if the above abnormalities are corrected.
A pressure transducer primed with normal saline is connected to the anterior catheter via the three-way tap, in order to record the infant’s intracranial pressure (ICP) throughout treatment (see FIGURE 3). Once this is connected, the pressure transducer needs to be carefully zeroed. This is achieved by opening the transducer to air in line with the centre of the infant’s head.

Recording true ICP

The infant’s ICP is continuously monitored during the procedure with an upper alarm limit set to alarm if it exceeds 6mmHg. The pressure of the infusion can increase the ICP measurement by 1-2mmHg, therefore, every 30 minutes the infant’s ‘true’ ICP must be documented. This is done by turning the three-way tap connected between the ICP transducer and the artificial CSF infusion off to the infusion. It is also essential that every time the infant’s head position is changed, or an unusual ICP measurement is shown (or at least
eight hourly) the ICP transducer is zeroed in line with the centre of the infant’s head (as explained above), to ensure its accuracy.

**Trouble shooting**

If the drained volume is less than 10mL in any 30-minute period but the infant’s ICP is less than 6mmHg, the nurse must lower the height of the reservoir by 1cm and continue infusing and draining CSF. However, if the ICP is greater than 6mmHg, the infusion must be stopped and the draining continued, but the reservoir must be lowered by 2cm. When the ICP has fallen below 6mmHg, the infusion can recommence.

If the rate of drainage decreases and the ICP remains over 6mmHg, the infusion can recommence.

Then a second dose of rTPA may be necessary to unblock the catheters. On some occasions it has been necessary to swap the anterior and the posterior catheters to reverse the flow, thus flushing the clot back into the ventricle and enabling the catheters to drain freely. This process often encourages the clot to break down further allowing it to pass through the opposite catheter (the anterior catheter will then be connected to the drainage system, and the posterior catheter will be used to infuse the artificial CSF). A blockage occurring between the right and left ventricles would cause one ventricle to be larger than the other and could be resolved by carrying out the above process, along with positioning the infant’s head so that the dilated ventricle is uppermost.

**Possible risks/side effects of treatment**

Ventricular lavage is a highly technical and invasive procedure that has some risks/side effects that nursing staff need to be able to recognise and manage, in order for treatment to be successful, eg there is a risk of a secondary haemorrhage, which is increased if the infant is particularly active. Nursing staff should ensure that the infant is comfortable throughout, firstly by using non-medical means such as positioning aids, ensuring that noise/light etc are kept to a minimum. If these methods are unsuccessful further pain relief, and often muscle relaxants may be necessary. If despite these efforts the infant shows clinical signs of having a secondary haemorrhage such as, becoming pale, starting to have jittery movements, increase in heart rate and decrease in blood pressure, the medical team must be informed immediately.

In addition to having a secondary haemorrhage, there is a risk of the infant acquiring a CSF infection. Daily sampling of drainage fluid for bacterial and microscopic testing helps to detect any infection. If infection is suspected, this may be treated with intravenous vancomycin and cefotaxime, while ventricular lavage continues.

Very occasionally the catheter sites have been found to leak CSF. The nurse caring
for the infant must observe for signs of this and will need to try to measure any leakage, ensuring that this is added to the total CSF losses. It may be necessary for the neurosurgeon to re-suture/re-dress the catheter site to prevent further leakage.

**Nursing competencies**

Due to the complexity of caring for an infant and their family while undergoing ventricular lavage, it is essential to have a dedicated team of nursing staff that has a specific interest in ventricular lavage to ensure that high standards of care are met. The team in Southmead Hospital has devised a set of guidelines for medical and nursing staff including a ventricular lavage checklist, care plan and nursing competencies. It is vital that staff undergo training and achieve the competencies required to care for these infants and their families.

**Family-centered care**

Giving birth to a premature infant is an extremely stressful experience for any parent. They are often not prepared for the birth, physically, emotionally or psychologically. Having an unwell infant during this particularly stressful time. Nursing staff can also teach parents about the care. Parents are regularly updated and the doctors take time to show, and explain to parents so that they can be near their baby during this this. Parents are regularly updated and the doctors take time to show, and explain to parents so that they can be near their baby during this particularly stressful time.

In preparation for DRIFT 2, the team at Southmead are working to simplify ventricular lavage to make it easier and safer to perform and teach.

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**References**