CARDIAC CATHETERISATION: INTERVENTIONAL, NON-INTERVENTIONAL AND ELECTROPHYSIOLOGICAL STUDIES - CHW

PRACTICE GUIDELINE ©

DOCUMENT SUMMARY/KEY POINTS

- When applicable observations should be performed every half hourly for the first 2 hours, hourly for the next 2 hours, 2nd hourly for the following 2 hours and then 4th hourly until discharge.
- When applicable the patient should lay flat and the affected limb to be kept straight for the first 4 hours following venous access and 6 hours following arterial access.
- Contact the Cardiology Fellow if any complications occur – such as haemorrhage, formation of a haematoma at the puncture site or poor perfusion to the limbs, vomiting, fever or arrhythmias.
- If bleeding occurs at the puncture site, apply continuous positive pressure above the site.

CHANGE SUMMARY

- Due for mandatory review
- Section on Endomyocardial biopsy (EMBx) added
- References updated
- Cardiac catheter laboratory transfusion guidelines added

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

Approved by:	SCHN Policy, Procedure and Guideline Committee	
Date Effective:	1st September 2014	**Review Period**: 3 years
Team Leader:	A/Clinical Nurse Educator	**Area/Dept**: Edgar Stephens Ward

READ ACKNOWLEDGEMENT

- All Nursing staff caring for patients with or requiring cardiac catheterisation (e.g. in Middleton, Turner and Edgar Stephen Wards) should read and acknowledge this document.

TABLE OF CONTENTS

Glossary of terms

Non-interventional or diagnostic Cardiac Catheterisation (CC), Angiogram and Endomyocardial biopsy (EMBx)

- A small catheter is inserted into a large vein or artery, dye can be injected and x-ray is used to record the flow and pressures in the heart and major vessels to interpret anatomy and physiology[1,2].
- EMBx is currently the gold-standard diagnostic tool in detecting rejection post heart transplant [3]. The procedure is performed in the catheterization laboratory and can be performed in 15 to 30 minutes. During the procedure several (4-5) isolated pieces of tissue are collected, stained and examined[3,4]. The level of rejection is reported by the histopathologist using the ISHLT grading system[4]. The result of the biopsy influences the anti-rejection regimen, and is guided by the treating team.

Interventional Cardiac Catheter (CC)

- Cardiac catheterisation allows a specific treatment to be performed on the heart. A device may be inserted via the cardiac catheter to close a congenital heart defect or a balloon to dilate a valve, stenosed vein or artery[5,6].

Electrophysiological Studies (EPS)

- EPS are performed via cardiac catheterisation which allows the electrical activity within the heart to be 'mapped out'. EPS provides essential information about abnormal heart rhythms and problems with the hearts conduction system. Radio Frequency Ablation (RFA) or Cryoablation is usually conducted at the same time, which allows the extra pathway which may be present in arrhythmias such as Supraventricular tachycardia to be destroyed by burning or freezing the muscle around the extra/accessory pathway[7,8].

Introduction

Rationale

The purpose of this document is to adequately prepare and manage children undergoing cardiac catheterisation; having an interventional or procedural cardiac catheter or an electrophysiological study (EPS) in order to enhance recovery and minimise post-operative complications.

Admission

For non-emergency cases, at the discretion of the child's Cardiologist, some children who are at high risk may be admitted into hospital the day before the procedure whilst others will be admitted day of surgery.

1 Pre-operative preparation

1. Routine nursing admission procedures should be followed refer to CHW **Admitting a patient to the ward Nurses Role in Orientating Families/carers** procedure: http://chw.schn.health.nsw.gov.au/o/documents/policies/procedures/2006-8008.pdf
2. Accurate weight and height will aid the Cardiologist to choose the appropriate catheter size[9].
3. Check vital signs: temperature, pulse, respirations, blood pressure and oxygen saturations. Pulse rate should be checked for *one minute* for signs of any arrhythmias.
4. Assess and document baseline neurovascular observations. Check all four limbs and assess all pulses including the dorsalis pedis, posterior tibial and radial[9].
5. Obtain an up-to-date history of the child's current medication regime from the parents/carer. Some medications will need to be ceased pre-operatively after discussion with the Cardiologist.
6. Ensure consent form is signed and completed.
7. Fasting times are to be ordered by an Anaesthetist for all procedures. An anaesthetist can also order pre medications if needed.
8. Some children may require intravenous (IV) fluids to prevent dehydration[9.] The Cardiology team and anaesthetist will identify any patients who require IV access.
9. Give the patient a bath on the morning of the procedure using a chlorhexadine gluconate 2% body wash.
10. Inform parents/carers of all pre-operative and post-operative care needs.
11. All high risk cardiac catheterisations must have a post-operative bed booked via the Theatre Scheduler in PICU.
12. Pre-operative tests should be organised by the Nursing staff caring for the patient. (See *Investigations* below).

Investigations

Cardiac catheter laboratory transfusion guidelines:

Risk	Defect/Cardiac condition/Procedure	Investigation
Low Risk	Patent ductus arteriosis (PDA) >4kg Atrial septal defect (ASD) Patent foramen ovale (PFO) Neonatal balloon atrial septostomy (BAS) Diagnostic catheter Collateral occlusion EMBx Balloon pulmonary valve >6/12	No investigations
Moderate Risk	Balloon pulmonary valve <6/12 Balloon aortic valve Radiofrequency (RF) perforation Coarctation angioplasty/stent Pulmonary atresia (PA) Cutting balloon angioplasty Transeptal puncture Ventricular septal defect (VSD) closure All neonatal catheters	The following should be performed with alterations only at the discretion of the cardiologist and anaesthetist: Cath lab registrar to arrange request forms for blood tests. When under general anaesthetic: Group and hold FBC, EUC
High Risk	Cardiac surgery Known bleeding Severe pulmonary hypertension (PHT) Paediatric intensive care (PICU)/Grace neonatal inpatients	All investigations to be completed before going to the cardiac catheter lab

Note: If there is any doubt please discuss with the consultant cardiologist performing the catheter.

Electrophysiological Study (EPS):

- ECG attended prior to procedure

Information specific for Electrophysiological Study (EPS)

The following information should be read in addition to the above pre-operative care for patients undergoing an EPS.

- This procedure is performed at Westmead (adult) Hospital and the patient is usually cared for post-operatively on Edgar Stephen Ward (ESW).
- The EPS procedure is performed on a Tuesday at the Cardiac Catheter Laboratory at Westmead Hospital.

- Patients undergoing an EPS are admitted on the day of procedure to Middleton Ward where the admission process is completed.
- However, patients requiring medications to be ceased prior to the EPS procedure and require hospitalisation to stabilise them must be admitted directly to ESW.
- ESW staff are responsible to:
  - Set up the bed and equipment on Monday evening for the transfer to Westmead Hospital on Tuesday morning (see equipment required on following page).
  - Arrange for a porter to deliver the assembled bed and equipment to Middleton Ward on Tuesday morning.
- A 'Day admitted patient leave' will need to be organised by the ward transferring the patient to Westmead Hospital. Refer to CHW **Admitted Patient Leave** Policy: http://chw.schn.health.nsw.gov.au/o/documents/policies/policies/2006-8333.pdf
- The porter will transfer the bed to Westmead Hospital with the patient in it. The parents/carers accompany the porter. There is no need for a nurse to escort the patient to Westmead Hospital unless the patient has an acute condition warranting close monitoring.
- Contact the Cardiac Clinical Nurse Consultant (CNC) or the patient's cardiologist if the child has respiratory symptoms, fever, vomiting, diarrhoea or any concerns from the parents regarding the child's wellness.

The equipment required for EPS set up:

- Appropriate size bed
- Oxygen cylinder with high flow meter
- Portable suction unit
- IV pole attached to bed
- EPS backpacks containing additional equipment are available in ESW. These are categorised into age groups: 0-5 years, 5-10 years and 10+ years old (age appropriate sizes contained within each pack). These contain the following:
  - Laerdal resuscitator and mask
  - Oxygen mask and tubing
  - Suction catheters size 10 and 12
  - Yanker sucker
  - Gloves
  - Kidney dish and vomit bag
  - Combine dressing
  - Gauze

The following are brought in by the RN when collecting the patient from Westmead Hospital.

- Portable Philips monitor® (Intellivue X2®)
- Appropriate size BP cuff and lead
- ECG leads and spare electrodes
- Appropriate size pulse oximeter probe and cable

Collection of the patient from Westmead Hospital

A Registered Nurse from ESW is required to collect the patient from Westmead Hospital. Westmead Hospital will arrange a porter for the return trip to ESW. The child must be attached to a cardiac monitor at all times during the transfer from Westmead Hospital Recovery Ward to ESW.

Note: In some instances, there may be patients returning to CHW PICU. For these occasions, a PICU team (medical and nursing staff) will normally be required to safely transfer the child.

Handover

A complete handover must be obtained when collecting the child. This must include the location and condition of puncture site(s), venous or arterial access, distal limb perfusion and whether the procedure was successful or unsuccessful.

Information Specific for EMBx

All patients post heart transplant are monitored indefinitely by biopsy, with variation in frequency of monitoring varying between units.

At Sydney Children's Hospital Network (SCHN), Westmead campus, the following schedule is recommended:

- Pre discharge
- 2 months post transplant
- 6 months post transplant
- Annual reviews

This protocol is open to variation at the discretion of the Cardiologist. Additional biopsies will be performed:

- When rejection is a clinical concern
- With significant changes in anti-rejection treatment
- As per Royal Children's Hospital, Melbourne (RCH) protocol for patients transplanted by the RCH team.

2 Post-catheter Management – CC and EPS patients

Bedside Setup

Before receiving the child back into the ward the Registered Nurse must check the equipment in the emergency drawer and assemble at the bedside. Refer to CHW **Cardiopulmonary Resuscitation and Equipment** practice guideline: http://chw.schn.health.nsw.gov.au/o/documents/policies/guidelines/2006-8239.pdf

- gloves
- combine dressing pad
- kidney dish and vomit bag
- appropriate size BP cuff, ECG leads and electrodes, pulse oximeter probe and cables

Observations performed

Note: The following observations are for all CC and EPS patients except EMBx patients– see EMBx specific instructions on page 11.

Perform the following:

1. The child should be reviewed by the Cardiology Resident or Registrar on arrival to ESW and by the sub specialty doctor if after hours.
2. The patient should lay flat and the affected limb to be kept straight for the first 4 hours following venous access and 6 hours following arterial access[9].
3. Record pulse, respirations, blood pressure, neurovascular and puncture site observations as follows[8]:
    - half-hourly for 2 hours
    - hourly for 2 hours
    - 2nd hourly for 2 hours
    - 4th hourly until discharge.
4. Check temperature on arrival and if stable, check 4th hourly.
5. Record these findings on the Standard Paediatric Observation Chart (SPOC), ensuring findings are within normal parameters for age group as per the CHW **Between the Flags- Clinical Emergency Response System** procedure guideline: http://chw.schn.health.nsw.gov.au/o/documents/policies/procedures/2012-8013.pdf

Note: Depending on cardiac defect, the child's oxygen saturations may not be within normal range on the SPOC chart. Consult with cardiology team to establish target oxygen saturation for individual child. If child's vital signs are not within normal parameters, ensure altered criteria is documented and reviewed every 48 hours.

6. All children should be attached to a cardiac monitor post-operatively until review by the cardiology team the following day.
7. Administer oxygen with caution and in consultation with cardiology team for children with an unrepaired cardiac defect.
8. When tolerating diet, the peripheral intravenous cannula (PIVC) may be capped. If the child is remaining in hospital overnight, do not remove PIVC until review the following day unless specified by the cardiac team.

Safe Guard Air Pressure Dressings

- 7ml balloon: remove 1ml/hr until all air is removed.
- 40ml balloon: remove 5mls/hr until all air is removed.
- If bleeding occurs, reinflate with last amount of air removed and contact the Cardiology Fellow
- Remove dressing before discharge

Medications

- Paracetamol for pain relief if necessary[9].
- Antiemetic's can be given for nausea if necessary.
- If the child has had an interventional cardiac catheterisation, an IV antibiotic single dose may be prescribed postoperatively.
- Aspirin may be prescribed to children post EPS (left sided ablations) and interventional catheterisation ASD closures or stents[6,10]. Aspirin should be administered as soon as patient is tolerating oral intake.

Parent/caregiver education

After the procedure, the RN should commence education with the child/patent/carer in:

- Notifying nursing staff if any bleeding or vomiting occurs[8].
- Getting assistance to get out of bed the first time as orthostatic hypotension may occur[8,11].

Observations specific to post EMBx

1. Apply cardiac and oxygen saturation monitoring
2. Record pulse, respirations, blood pressure, and puncture site observations as follows:
    - half-hourly for first hour
    - hourly until discharge
3. Visualise the puncture site and gently palpate the area to assess for a possible haematoma.
4. Check temperature on arrival and if stable, check 4th hourly.

EMBx with general anaesthetic:

- In younger patients the procedure requires a general anaesthetic and catheter entry site will be through the jugular vein in most cases. Access may be gained through the femoral arteries when the cardiac catheter is being performed for additional reasons, for example coronary angiography. In these cases the routine observations and discharge are as per the cardiac catheter post-operative standard protocol.

EMBx with sedation and local anaesthetic:

- In adolescents this procedure can be performed using sedation and local anaesthetic. For these patients the observations and nursing management will differ. The catheter entry site for these patients will be through the right internal jugular vein and therefore patients will not need neurovascular observations, nor will they need to lay flat and still.

Possible Complications related to Cardiac Catheterisation/EPS [2,7,8,9,12,13]

Complication	Management	Notify
Haemorrhage from puncture site	Immediately apply continuous pressure to puncture site.	Notify cardiac team immediately.
Haematoma at puncture site or poor perfusion in limbs	Increase frequency of neurovascular observations of affected limb.	Notify cardiac team as soon as possible.
Vomiting	Keep on clear fluids. Consider administer anti-emetic and/or increasing IV fluids. Always check puncture site(s) for bleeding after a vomit.	If vomiting persists, child should be reviewed as soon as possible.
Fever	If child uncomfortable with fever, consider giving paracetamol after informing cardiac team of fever.	Inform cardiac team
Arrhythmia	Assess the child's cardiac output. If not compromised, a clinical review or rapid response may need to be called. If child is compromised with arrhythmia, an arrest call may need to be made and resuscitation commenced.	If not compromised inform cardiac team/clinical review/rapid response depending on arrhythmia. If compromised, an arrest call may need to be made.

Other Complications

- Renal failure may be related to contrast injection; watch for haematuria, proteinuria, oliguria, and anuria[14].

Discharge Management

1. Patient must be reviewed by the cardiology team prior to discharge.
2. If there is visible ooze at the puncture sites, change the dressing and replace with new steri-strips before discharge and document the change in the patient's notes. Consult with cardiac CNC if wound/dressing follow up required.
3. Organise follow-up appointments if required.
4. Discharge medications such as aspirin may be ordered for some EPS patients and device closure patients. Check with the cardiology team prior to discharge for instructions.

Post EMBx:

Discharge criteria:

Once patients satisfy the below criteria they are able to be discharged:

1. Cardiovascular function and airway patency are satisfactory and stable
2. The patient is easily rousable, and protective reflexes are intact.
3. The patient can talk (if age appropriate).
4. The patient can sit up unaided (if age appropriate).
5. The child has returned to his/her pre-sedation level of responsiveness.
6. The state of hydration is adequate.
7. Absence of respiratory distress
8. Minimal pain
9. No significant nausea, vomiting and dizziness
10. Echocardiogram attended and reviewed by Cardiologist
11. No active bleeding or haematoma at puncture site.
    - In addition to the above, patients who have undergone general anaesthetic or those who have had arterial access, such as with coronary angiography , will need to remain in hospital under observation for the full four hours post procedure.
    - Follow up arrangements will be coordinated by the Clinical Nurse Consultant or Cardiologist once results are available.

Pre-discharge tests

Nursing staff caring for the patient are responsible to ensure the following tests are performed day 1 post-procedure. These tests should be performed prior to cardiac ward round when possible.

Non-intervention or Diagnostic cardiac catheter

- Usually no tests will be required; however this will be at the Cardiologist's discretion.

Interventional cardiac catheter

- ECG (ASD and VSD device closures only)
- Echocardiogram

EPS

- ECG

Discharge Instructions

A discharge information sheet should be handed to the parents by the RN. The following are outlined in this sheet.

1. No strenuous activity should be performed for 1 week post- procedure [12].
2. Call the Hospital if circulation changes in the affected limb or if there is numbness, colour change, or temperature change[14].
3. Seek medical advice if there are any signs of infection at the puncture site or swelling, redness, pain or if the child has a fever >38.5[14].
4. Paracetamol may be given for pain.
5. Observe the puncture sites for haematoma and bleeding. Lay the patient flat and apply pressure for at least 5 minutes and contact the Hospital.
6. Steri-strips are to be changed day of discharge and left intact for 24hrs. Once steri-strips are removed it is preferred patients shower for the 5 days and can resume normal bathing after this.
7. If vomiting occurs, offer frequent drinks and a light diet. Patient should continue to pass urine. Seek medical advice if there is decreased urinary output.
8. Seek medical advice or present to the nearest Emergency Department if there are any concerns.

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