

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

PRACTICE GUIDELINE [®]

DOCUMENT SUMMARY/KEY POINTS

- Observations should be performed every half hour for the first 2 hours, hourly for the next 2 hours, 2nd hourly for the following 2 hours and then 4th hourly until discharge unless otherwise specified.
- 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 unless otherwise specified.
- Contact the on-call cardiology fellow via switchboard if any complications occur – such as haemorrhage, formation of a haematoma at the puncture site or change in neurovascular observations to the limbs, vomiting, fever or arrhythmias.
- If bleeding occurs at the puncture site, apply continuous pressure above the site.
- Patient must be reviewed by a cardiologist or cardiology fellow prior to discharge. There are some EPS patients that may be eligible for discharge after review by junior medical staff and this will be clearly documented in the patient's notes.

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:	1 st September 2021	Review Period: 3 years
Team Leader:	Clinical Nurse Consultant	Area/Dept: Cardiology

CHANGE SUMMARY

- References updated
- Complications section expanded

READ ACKNOWLEDGEMENT

- Nursing staff in Middleton and Edgar Stephen Ward should read and acknowledge this document.

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:	1 st September 2021	Review Period: 3 years
Team Leader:	Clinical Nurse Consultant	Area/Dept: Cardiology

TABLE OF CONTENTS

1	Glossary of terms	4
	Non-interventional or Diagnostic Cardiac Catheterisation (CC), Angiogram and Endomyocardial Biopsy (EMBx).....	4
	Interventional Cardiac Catheter.....	4
	Electrophysiological Study	4
2	Introduction	5
2.1	Rationale	5
2.2	Admission	5
3	Pre-operative preparation	5
3.1	Investigations.....	6
	<i>Cardiac catheter laboratory transfusion guidelines:</i>	6
	<i>Electrophysiological Study (EPS):</i>	6
3.2	Information specific to Electrophysiological Study (EPS)	7
	<i>Collection of the patient from Westmead (adult) Hospital</i>	8
	<i>Handover</i>	8
3.3	Information Specific to Endomyocardial Biopsy	8
4	Post-catheter management – CC and EPS patients	9
4.1	Bedside setup.....	9
4.2	Observations- CC and EPS patients	9
4.3	Observations specific to post EMBx	10
	<i>EMBx with general anaesthetic:</i>	10
	<i>EMBx with sedation and local anaesthetic:</i>	10
4.4	Safeguard® Pressure Assist Device dressings	11
4.5	Medications	11
4.6	Parent/caregiver education.....	11
4.7	Possible complications related to cardiac catheterisation/EPS ^{3,8,9,11,14,15}	12
5	Discharge management	13
5.1	Preparation for discharge	13
5.2	Pre-discharge tests.....	13
	<i>Non-intervention or diagnostic cardiac catheter</i>	13
	<i>Interventional cardiac catheter and EMBx</i>	13
	<i>EPS</i>	13
5.3	Day Stay Patients	14
5.4	Discharge Criteria for Eligible Day Stay Patients	14
5.5	Discharge Instructions for EPS and Cardiac Catheter Patients	15
6	References	16

1 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 and is used to record pressures and saturations. Contrast (“dye”) can be injected and x-ray is used to visualize the anatomy. The information obtained is used to interpret the anatomy and physiology^{1,2}.
- EMBx is currently the gold-standard diagnostic tool in detecting rejection post heart transplant³. The procedure is performed in the catheterisation laboratory and can be performed in 15 to 30 minutes. During the procedure several (4-5) isolated pieces of cardiac tissue are collected, and sent to the laboratory to be stained and examined^{3,4}. The level of rejection is reported by the histopathologist using the ISHLT grading system⁴. The result of the biopsy influences the anti-rejection regimen, and is guided by the treating team.
- Coronary angiography involves injection of a radiopaque contrast media to allow for radiographical visualisation of the coronary vessels. It provides the most definitive evaluation of coronary vessels⁵. Coronary angiography is usually only performed in children post heart transplant as a routine assessment every 2 years due to the increased risk of cardiac allograft vasculopathy.

Interventional Cardiac Catheter

- Cardiac catheterisation allows a specific treatment to be performed on the heart or the great vessels. Typical catheter based interventions include (but are not limited to):
 - Balloon angioplasty – inflation of a balloon to open a stenosis vessel
 - Balloon Valvuloplasty- inflation of a balloon to open a stenosed valve
 - Stent angioplasty – insertion of a metal stent to keep a vessel patent. Stents can also be inserted to keep a ductus arteriosus patent (in neonates), to open the RV outflow tract, to treat coarctation of the aorta
 - Device implants – to close a patent ductus arteriosus, close an Atrial septal defect, close a ventricular septal defect, embolise collateral vessels
 - Implant percutaneous pulmonary valves (melody valves, or Edwards-Sapien valves)⁷

Electrophysiological Study

- Electrophysiological Study (EPS) is 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 cardiac conduction system. If located, radio frequency ablation (RFA) (burning) or cryoablation (freezing) of the abnormal conduction tissue can be performed.^{8,9} These methods are used to destroy any extra pathways or foci which may be present, for example in arrhythmias such as supraventricular tachycardia.

2 Introduction

2.1 Rationale

The purpose of this document is to guide the pre and postoperative management of children undergoing cardiac catheterisation (diagnostic or interventional) or EPS, in order to enhance recovery and minimise postoperative complications.

Prior to admission, patients and families should be adequately prepared for what to expect from the procedure and admission to hospital. This includes providing information regarding potential risks and the expected length of stay, but also addressing their psychosocial needs. Access to a child life therapist and clinical psychologist should be facilitated as is necessary¹⁰.

2.2 Admission

For most non-emergency cases the child will be admitted to hospital on the day of surgery. Some high-risk patients may require admission to hospital in the days before the procedure. This will be at the discretion of the treating cardiologist.

3 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://webapps.schn.health.nsw.gov.au/epolicy/policy/14>
2. Record accurate weight and height. This will aid the cardiologist to choose the appropriate catheter size⁹
3. Check vital signs: temperature, pulse, respirations, and blood pressure and oxygen saturations. Pulse rate should be palpated or auscultated for a full 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 radial¹¹
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.
 - i. EPS (antiarrhythmic medications): 5 days prior.
 - ii. Cardiac catheter: All medications can be continued up until the day before the procedure. Patients on warfarin should be discussed case-by-case with the cardiologist.
6. Ensure consent form is completed and signed. The signed consent form is typically kept by the cardiology department and is available in the cath lab on the day of the procedure
7. Fasting times are to be ordered by an anaesthetist for all procedures. The anaesthetist can also order premedications if required.

8. Some children may require intravenous (IV) fluids to prevent dehydration.¹¹ The cardiology team and anaesthetist will identify any patients who require IV access.
9. The patient should bathe/shower the morning of the procedure
10. Inform parents/carers of pre-operative and post-operative care needs.
11. All high risk cardiac catheterisations must have a PICU post-operative bed booked. If a PICU bed is needed, this will be identified by the cardiologist / cath lab fellow prior to the procedure.
12. Infectious status should be verified.

3.1 Investigations

Cardiac catheter laboratory transfusion guidelines:

Risk	Defect/Cardiac condition/Procedure	Investigation
Low Risk	Patent ductus arteriosus (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):

- 12 lead ECG attended prior to procedure and made available in notes.

3.2 Information specific to 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 postoperatively on Edgar Stephen Ward (ESW).
- The EPS procedure is performed at the Cardiac Catheter Laboratory at Westmead adult Hospital.
- Patients undergoing an EPS are admitted on the day of procedure to Middleton Ward where the admission process is completed.

However, patients who require hospitalisation for medication cessation prior to the EPS must be admitted directly to ESW.

- ESW staff are responsible for:
 - Setting up the bed and equipment on the evening before the booked case and transfer to Westmead Hospital on morning of the procedure (see equipment required as follows).
 - Arranging for a porter to deliver the assembled bed and equipment to Middleton Ward the morning of the procedure.
- A 'Day admitted patient leave' will need to be organised by the ward transferring the patient to Westmead Hospital. Refer to [Admitted Patient Leave Policy](#).
- 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 (incl. cylinder holder) with high flow meter
- Portable suction unit
- EPS backpack containing additional equipment (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

- ECG dots
- SpO₂ probe and self-adherent wrap (e.g.Coban)
- Gloves
- Vomit bag
- Combine dressing
- Gauze

The following are taken with 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
- Patient's arrest drug form

Collection of the patient from Westmead (adult) 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 and oxygen saturation 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 patient.

Handover

A complete handover must be obtained when collecting the child from Westmead Hospital. This must include the location and condition of puncture site(s), venous or arterial access, distal limb perfusion (incl. assessment of peripheral pulses) and whether the procedure was successful or unsuccessful. Confirmation of medications given intra and postoperatively, including time of administration, must also be ascertained.

3.3 Information Specific to Endomyocardial Biopsy

All patients post heart transplant are monitored indefinitely by biopsy.

The endomyocardial biopsy (EMBx) schedule will be determined by the treating cardiac transplant team.

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

- When rejection is a clinical concern
- With significant changes in anti-rejection treatment

- With guidance from The Royal Children's Hospital, Melbourne (RCH) (for patients transplanted by RCH team)
- If weaning of steroids occurs outside of the normal regimen
- Patients undergoing biopsy should not have their anti-rejection medication the morning of the catheter procedure as a trough blood level is taken at the time of the biopsy.

4 Post-catheter management – CC and EPS patients

4.1 Bedside setup

Before receiving the child back into the ward the registered nurse must check that there is a post-operative pack at the bedside. This must include:

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

Refer to [Cardiopulmonary Resuscitation and Equipment practice guideline](#).

4.2 Observations- CC and EPS patients

Note: The following observations are for all CC and EPS patients except EMBx patients—see EMBx specific instructions on page 10.

Perform the following:

- The child should be reviewed by the cardiology resident or registrar (or the sub specialty doctor if after hours) on arrival to the ward.
- 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 access¹¹.
- Record pulse, respirations, blood pressure, neurovascular and puncture site observations as follows⁹:
 - half-hourly for 2 hours
 - hourly for 2 hours
 - 2nd hourly for 2 hours
 - 4th hourly until discharge.
- Neurovascular observations are of particular importance due to the risk of either thrombus or device occlusion of vessels. If decreased perfusion is noted, the team leader and medical staff must be informed immediately. Doppler may be required to ascertain if there is blood flow through a vessel.

- Check temperature on arrival and if stable, check 4th hourly.
- Record these findings on the age-appropriate observation chart (SPOC), ensuring findings are within normal parameters for age group as per the [Between the Flags- Clinical Emergency Response System procedure](#).
- Note: Depending on cardiac defect, the child's oxygen saturations may not be within normal range on the observation chart. Consult with cardiology team to establish target oxygen saturation for individual child. If child's vital signs are not within standard parameters, ensure altered criteria is documented and reviewed every 48 hours.
- All children should be cardiac monitored post-operatively. Administer oxygen with caution and in consultation with cardiology team for children with an unrepaired cardiac defect.
- 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.

4.3 Observations specific to post EMBx

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 standard cardiac catheter post-operative protocol.
- If access is through the jugular vein only (no femoral access) the following observation protocol applies:
 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.
 5. These patients are not required to lie flat

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.

- For these patients record pulse, respirations, blood pressure, and puncture site observations as follows:
 - On arrival
 - Hourly for 4 hours

4.4 Safeguard® Pressure Assist Device dressings

- 7mL balloon: remove 1ml/hour until all air is removed
- 40mL balloon: remove 5mls/hour until all air is removed
- If bleeding occurs, reinflate with last amount of air removed and contact the on-call cardiology fellow via switch
- These dressings should be left intact overnight.
- Remove Safeguard® dressing before discharge. Clean the sites with 0.1% Chlorhexidine gluconate prior to redressing and redress site with new steri-strips.

4.5 Medications

- Paracetamol for pain relief if necessary¹¹
- Antiemetics can be given for nausea if necessary
- If the child has had an interventional cardiac catheterisation, a single dose of IV antibiotic may be prescribed postoperatively.
- Aspirin may be prescribed to children post EPS (left sided ablations) and interventional catheterisation (VSD and ASD closures or stents).^{7,12} Aspirin should be administered as soon as patient is tolerating oral intake.

4.6 Parent/caregiver education

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

- Notifying nursing staff if any bleeding or vomiting occurs.⁹
- Getting assistance to get out of bed the first time as orthostatic hypotension may occur.^{9,13}

4.7 Possible complications related to cardiac catheterisation/EPS

3,8,9,11,14,15

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

Other Complications

- Renal failure may be related to contrast injection; watch for haematuria, proteinuria, oliguria, and anuria¹⁶
- Pericardial effusion and tamponade – the risk for this is small, however tamponade can be fatal.¹⁷ Signs include increased HR, pallor, decreased perfusion and altered level of consciousness. A drop in BP is a late sign.
- Device migration is a rare complication. However, if it does happen it usually occurs at the time of the procedure or no later than 12 hours post. A sign of potential intra-cardiac device embolization may be arrhythmia – commonly multiple ventricular ectopics. If suspected, an urgent echo is required. Contact the on-call cardiology fellow via switch. The cardiologist is to decide on further investigations. Keep patient fasted as they may need to return to cardiac catheter laboratory urgently.

5 Discharge management

- Some cardiac catheter and EPS patients may be suitable for day stay only – refer to sections 5.3 and 5.4 for further information

5.1 Preparation for discharge

- Patient must be reviewed and approved for discharge by the cardiology fellow or consultant prior to discharge. On some occasions a junior medical staff member may authorise discharge and this will be documented in the notes.
- Remove the dressing and replace with new steri-strips before discharge to ensure visualisation of wound site. Document assessment in the patient's eMR. Consult with cardiac CNC if wound/dressing requires follow up.
- Ensure follow-up appointments are arranged as required. For EMBx patients follow up arrangements will be coordinated by the cardiac Clinical Nurse Consultant (CNC) or Cardiologist once results are available
- Discharge medications such as aspirin, may be ordered for some patients. Check with the cardiology team prior to discharge for instructions.
- If infective endocarditis prophylaxis is required, this information should be provided to the patient and family at discharge.
- Education should be provided to the patient and caregivers regarding care of the catheter entry site wound and signs of complications to be aware of once discharged.
- Provide "Cardiac Catheter and Electrophysiology Study Discharge Information" fact sheet.

5.2 Pre-discharge tests

Nursing staff caring for the patient are responsible to ensure the following tests are performed day 1 post-procedure (or prior to discharge if the patient is a same day discharge patient). For overnight stay patients 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 interventional cardiologist's discretion.

Interventional cardiac catheter and EMBx

- Echocardiogram
- 12 lead ECG (ASD and VSD device closures only)
- For patients post-EMBx a tacrolimus blood level will have been taken during the procedure and the transplant team will follow up this result.

EPS

- 12 lead ECG

5.3 Day Stay Patients

- Certain patients may be suitable for same-day discharge. Patients that may be suitable for day stay include:
 - Patients greater than 6 months of age who have undergone device closure of PDA, balloon pulmonary valvotomy, or simple diagnostic cardiac catheter
 - Older children who have undergone device closure of an ASD (age at cardiologist's discretion - dependent on nature of ASD)
 - Patients who have undergone EMBx
 - Certain patients post EPS as determined by the electrophysiology team
- Suitable patients will be identified by the interventional cardiologist or Electrophysiologist at time of booking and must be listed as first or second case.
- Patients with significant comorbidities are not suitable for same-day discharge.
- The patient must be able to return to the hospital the following day for follow up if required (i.e. must have Sydney-based accommodation).
- Patients eligible for same day discharge are required to remain inpatients for four to six hours following their procedure unless otherwise advised by the interventional cardiologist

5.4 Discharge Criteria for Eligible Day Stay Patients

Once the patient satisfies the following 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 patient has returned to his/her pre-sedation level of responsiveness
6. The patient is not experiencing significant nausea, vomiting or dizziness
7. The patient is eating and drinking and has passed urine post-operatively
8. The patient's state of hydration is adequate
9. The patient is not showing any signs of respiratory distress
10. The patient has minimal pain
11. There is no active bleeding or haematoma at puncture site and peripheral pulses are palpable
12. Pre-discharge tests are complete and results have been reviewed
13. Patients who have had their procedure under general anaesthetic or have had a procedure with arterial access have been observed in hospital for 4-6 hours post-procedure

14. The patient has been reviewed and approved for discharge by the cardiology fellow or consultant prior to discharge
15. No arrhythmia has occurred for the EPS patients.

5.5 Discharge Instructions for EPS and Cardiac Catheter Patients

The RN should explain and give a hard-copy of the discharge information sheet to the parent/ carer. This includes the following information:

1. No strenuous activity should be performed for 1 week post-procedure¹⁴.
2. Seek medical advice or present to the emergency department if circulation changes in the affected limb or if there are changes in sensation, colour, or temperature¹⁶.
3. Seek medical advice if there are any signs of infection: swelling, redness or pain at the puncture site, or if the child has a fever >38.5¹⁶.
4. Paracetamol may be given for pain.
5. Observe the puncture sites for haematoma and bleeding. If these occur lay the patient flat and apply pressure for at least 5 minutes. May need longer if on aspirin. If bleeding continues contact the hospital.
6. Steri-strips are to be changed day of discharge and left intact for 24 - 48hrs and should be removed 48 hours after discharge. No immersing the puncture sites (bathing or swimming) for 1 week, however showers are fine as these allow the water to run off.
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.
9. Children can usually return to school or childcare a few days after the procedure. This should be clarified with the cardiologist on discharge.
10. Infective endocarditis precautions may apply – please discuss this with your nurse before discharge. A fact sheet will be provided if these are applicable.
11. Patients who have undergone a percutaneous pulmonary valve implant require indefinite aspirin and lifelong endocarditis prophylaxis at times of risk

6 References

1. Chair SY, Thompson DR, Li SK. The effect of ambulation after cardiac catheterisation on patient outcomes. *Journal of Clinical Nursing*. 2007 Jan; 16(1):212-214.
2. Feltes TF, Bacha E, Beekman III RH, Cheatham JP, Feinstein JA, Gomes AS, Hijazi ZM, Ing FF, de Moor M, Morrow WR, Mullins CE, Taubert KA, Zahn EM. Indications for cardiac catheterization and intervention in pediatric cardiac disease: a scientific statement from the American Heart Association. *Circulation*. 2011 May; 123: 2607-2652.
3. Strecker T, Rösch J, Weyand M, Agaimy A. Endomyocardial biopsy for monitoring heart transplant patients: 11-years-experience at a German heart centre. *International Journal of Clinical and Experimental Pathology*. 2013 Jan 1; 6(1): 55-65.
4. Stewart S, Winters GL, Fishbein MC, Tazelaar HD, Kobashigawa J, Abrams J, Andersen CB, Angelini A, Berry GJ, Burke M.M, Demetris AJ, Hammond E, Itescu S, Marboe CC, McManus B, Reed EF, Reinsmoen NL, Rodriguez ER, Rose AG, Rose M, Suci-Focia N, Zeevi A, Billingham ME. Revision of the 1990 working formulation for the standardization of nomenclature in the diagnosis of heart rejection. *Journal Heart and Lung Transplant*. 2005 Nov; 24(11): 1710-20.
5. Stephenson M. Coronary angiography: Indications and Contraindications. Joanna Briggs Institute: Evidence Summary. 2017. JBI16834.
6. Andrews RE, Tulloch RMR. Interventional cardiac catheterisation in congenital heart disease. *Archives of Disease in Childhood*. 2004; 89: 1168-1173.
7. Gervaisi L, Basu S. Atrial septal defect devices used in the cardiac catheterization laboratory. *Progress in Cardiovascular Nursing*. 2009 Sep; 86-89.
8. Bosen DM, Flemming MA. Electrophysiologic testing. *Dimensions of Critical Care Nursing*. 2003 Jan/Feb; 22(1): 10-19.
9. Johns Hopkins Medicine. Electrophysiological studies [internet]. [cited 2017 September 29]. Available from: http://www.hopkinsmedicine.org/healthlibrary/test_procedures/cardiovascular/electrophysiological_studies_9_2,P07971
10. Levert EM, Helberg WA, Dulfer K, van Domburg RT, Utens & EMWJ. Psychosocial needs of children undergoing an invasive procedure for a CHD and their parents. *Cardiology in the Young*. 2017;27:243-254.
11. Hockenberry MJ, Wilson D. Wong's essentials of pediatric nursing. 9th ed. Missouri: Mosby; 2013.
12. Blanc JJ, Almendral J, Brignole M, Fatemi M, Gjesdal K, Gonzalez-Torrecilla E, Kulakowski P, Lip GYH, Shah D, Wolpert C. Consensus document on antithrombotic therapy in the setting of electrophysiological procedures. *Europace*. 2008; 10: 513-527.
13. Hinkle JL, Cheever KH. Brunner and Suddarth's textbook of medical-surgical nursing. 13th ed. Philadelphia: Wolters Kluwer Health, Lippincott Williams & Wilkins; 2014.
14. Nettina SM. Lippincott manual of nursing practice. 10th ed. Ambler, PA: Wolters Kluwer Health, Lippincott Williams & Wilkins; 2014.
15. National Heart, lung and blood institute. What are the risks of cardiac catheterization [Internet] 2017 Jan 30 [cited 2017 September 29]. Available from: <https://www.nhlbi.nih.gov/health/health-topics/topics/cath/risks>
16. Carroza JP, Cutlip D, Saperia GM. Complications of diagnostic cardiac catheterization [Internet]. [updated 2017 May 10; cited 2017 September 29]. Available from: http://www.uptodate.com/contents/complications-of-diagnostic-cardiac-catheterization?topicKey=CARD%2F1470&elapsedTimeMs=1&source=search_result&searchTerm=cardiac+catheterisation&selectedTitle=4%7E150&view=print&displayedView=full
17. Slawek S, Araszkiwicz A, Gaczowska A, Koszarska J, Celiński D, Grygier M, Lesiak M & Grajek S. Endomyocardial biopsy via the femoral access - still safe and valuable diagnostic tool. *BMC Cardiovascular Disorders*. 2016; 16: 1-8.

Copyright notice and disclaimer:

The use of this document outside Sydney Children's Hospitals Network (SCHN), or its reproduction in whole or in part, is subject to acknowledgement that it is the property of SCHN. SCHN has done everything practicable to make this document accurate, up-to-date and in accordance with accepted legislation and standards at the date of publication. SCHN is not responsible for consequences arising from the use of this document outside SCHN. A current version of this document is only available electronically from the Hospitals. If this document is printed, it is only valid to the date of printing.