



The Cardiac Society of Australia and New Zealand

## Guidelines for standards of practice in Paediatric Echocardiography

These guidelines were revised by Dr Robert Justo on behalf of the  
Paediatric and Congenital Council.

The guidelines were reviewed by the Continuing Education and Recertification Committee  
and ratified at the CSANZ Board meeting held on Wednesday, 10<sup>th</sup> August 2011.

### Introduction

This document has been prepared to provide guidelines for standards of practice in paediatric echocardiography.

Paediatric echocardiography should not be considered a substitute for a proper clinical opinion. In general such studies are best performed in conjunction with a paediatric cardiological review.

Supplementary guidelines were felt necessary because of the special requirements with respect to the patients, knowledge, and experience required by the echocardiographer, facilities and instrumentation required for proper paediatric studies. Different strategies are especially required for handling young children and their families compared with adult patients.

### Patients

Patients covered by this document are those within the paediatric age group, and in particular infants and young children. Adolescents and adults with repaired, palliated, or un-operated congenital heart disease also share many of the special requirements of paediatric echocardiography, and will frequently be best assessed by echocardiographers and services with capabilities outlined in this document.

### Paediatric Echocardiographer-Physician

Paediatric echocardiographers-physicians will have completed and have the following:

1. Knowledge of the physics of echocardiography, and its applications in cross-sectional, M-mode, and Doppler studies.
2. Supervised training in a tertiary echocardiography service, the majority of whose work will be paediatric echocardiography and the examination of patients with congenital heart disease.
3. An intimate knowledge of the pathology and physiology of congenital cardiac lesions, and normal developmental physiology in infants as it applies to paediatric echocardiography.
4. Familiarity with special views used in paediatric echocardiography, particularly the sub-xiphoid and right and left parasternal views.
5. An intimate knowledge of the acquired diseases of the heart in children.

6. An intimate knowledge of the usual findings and potential complications following palliation and repair of congenital heart disease.
7. Completed 300 self conducted paediatric echocardiographic studies (at least 250 with congenital or acquired heart disease) with the production of a provisional report, which will have been checked by a paediatric echocardiographer-physician.
8. Will have performed at least an additional 300 paediatric echocardiographic studies (at least 250 with congenital or acquired heart disease) in conjunction with and under the supervision of a paediatric echocardiographer-physician.

## Paediatric Sonographer-Technician

A paediatric sonographer-technician will have extensive training in paediatric echocardiography, have special knowledge of relevant issues in pre and post operative cases of congenital and acquired heart disease in childhood and will be predominantly involved in performing paediatric echocardiography. A paediatric sonographers-technician will invariably work under the supervision of a paediatric echocardiographer-physician.

## Ongoing Exposure

Paediatric echocardiographer-physician require at least yearly exposure of at least 250 of their studies to be in the paediatric age group (at least 150 with congenital or acquired abnormality). Some variations to this may apply as in “Special Considerations” below. Such expertise may be vested in one echocardiographer of a group practice.

## Quality Assurance

A quality assurance program is required in the practice of paediatric echocardiography and the study of congenital heart disease. Programs should establish the frequency of false negative and false positive diagnoses for representative portions of their practice, or maintain/perform audits based on outcomes. This quality assurance program should be linked with a major paediatric echocardiographic centre.

## The Equipment

Echocardiography machines should be equipped with appropriate contemporary technology for diagnostic paediatric studies. The highest priority is given to optimal 2 dimensional images and the equipment must be capable of M-mode, pulsed and continuous wave Doppler.

### Transducers

Minimum transducer requirements include a 5 MHz probe of short or medium focus, a 2.5 – 3 MHz probe and where neonatal studies are frequently performed a 7.5 MHz (or equivalent) probe should also be available.

### Transoesophageal Studies

These studies are not considered routine outpatient studies for paediatric patients and should be arranged as an in-patient day stay procedure with general anaesthetic support. They should be carried out only by qualified paediatric echocardiographer-physician and require appropriately selected paediatric probes where necessary.

### M-Mode

M-mode alone is inadequate for the evaluation of paediatric heart disease. It remains an important tool in the documentation of cardiac function, but its limitations in patients with congenital heart disease must be understood. This includes the avoidance of inappropriate quoting of left ventricular functional measurements in patients with abnormal interventricular septal motion or position. M-mode measurements should be reported with normal values appropriate for patient size.

**2D Imaging**

Should be considered of highest priority in paediatric echocardiography studies and equipment providing optimal performance in this area is required.

**Doppler**

Colour, pulsed and continuous wave Doppler is required for paediatric echocardiographic studies.

**Recording**

Each study should include standard paediatric echocardiographic views and sweeps and should be recorded on video tape or captured as a series of digital acquisitions. In either case, the recorded material should be retained / archived for future review where necessary.

**Storage**

The usual requirements for storage of studies apply, however due to the nature of paediatric studies these should be retained for 35 years. Indefinite storage is likely to prove necessary.

**Examination**

The examination is dictated by the need to demonstrate in a positive fashion all aspects of normal cardiac anatomy and physiology for all regions of the heart and great vessels.

A full examination requires sub-xiphoid short and long axis sweeps, apical 2 and 4 chamber sweeps, parasternal long axis view with right and left lateral sweeps, parasternal short axis views with apical to basal sweeps, supra-sternal views of the aorta, pulmonary arteries and innominate vein. Supplementary views of the ductal area, and right parasternal views of the inter-atrial septum may also be required.

Doppler interrogation of atrio-ventricular and semi lunar valves is required, with specific interrogation of the ductal diverticulum, foramen ovale and atrial septal region and aortic isthmus.

Where abnormal pathology is detected special focussed views of these areas are required with Doppler quantitation of appropriate flow disturbance. In patients with a circular left ventricle M-mode of the left ventricle for functional analysis is required, in addition to standard M-mode quantitation of aortic root and left atrium. Special views may be required (eg. coronary views in patients with Kawasaki's disease).

These studies will naturally be modified according to limitation in access or related to difficulties in patient condition. Omissions should be reported and accounted for at the conclusion of the study.

**Echocardiographer Attendance**

The echocardiographer-physician should be available to be present during a study and should be on site for routine studies.

**Duration of Study**

An average of 50 minutes paediatric echocardiographer-physician time is required involving performance or, partial or complete supervision of the study, reporting and review of the study and appropriate communication with referring practitioner.

Where full studies are performed by sonographer-technicians in conjunction with a paediatric echocardiographer-physician at least 30 minutes scanning time should be allocated for their completion. In many cases studies will be longer, especially when patient sedation is required.

**Co-operation**

A complete paediatric echocardiographic study requires the co-operation of the patient. When the patient fails to co-operate throughout or during part of the study this should be noted at its conclusion. Patients demonstrating poor co-operation throughout the study in general require postponement of the study to an alternate time or sedation.

## Reporting

Reporting of studies should address connections and anatomical relations, pertinent negative findings and positive findings and study quality. Where the study has been incomplete in any way, such as certain anatomical or functional features not determined for technical or other reasons, this should be stated in the report. Measurements should be quoted with size and age appropriate normals.

## Special Requirements

Special requirements exist for paediatric studies and include:

### Support Facilities

Suitable facilities for young children and parents should be available. This will include equipment to assist with calming young children.

### Body Size Measurements/Normal Values

Measures of height and weight should be available for each study and appropriate normal values should be used for analysis and reporting.

### Sedation

The availability of sedation and sedation protocols is required for appropriate cases.

Detailed recommendations for sedation are in Appendix 1.

In general sedation should not be administered where (1) definitive information will not be obtained, (2) where information that will change the course of a short or medium term management will not be obtained or (3) where the study will need to be repeated in the near future for re-validation of the information. That is, sedation should be restricted to obtaining definitive and necessary information.

## Indications for Study

The indication for paediatric echocardiographic study is to identify or better define pathology which cannot be otherwise confirmed by clinical evaluation, chest x-ray, and ECG. Repeat studies will generally be performed to identify the consequences of surgical or medical intervention, or to monitor pertinent features of lesion progress which cannot be confirmed by simpler means. Limited studies are rarely indicated, but may be performed, for example in the case of M-mode evaluations of ventricular function in selected high risk patient groups. Of necessity, studies performed in the operating room or intensive care unit may be limited, however the availability of transoesophageal access is desirable to supplement transthoracic or open chest studies in this setting. A decision to limit the extent of a study should be made only in conjunction with a paediatric cardiologist.

## Special Considerations

### **Centres & echocardiographer-physicians not complying with the "Guidelines for SPPE".**

In some centres, especially outside metropolitan areas, it may prove difficult to achieve minimum requirements for ongoing exposure or to comply with knowledge and experience requirements. In general studies are then best referred to an echocardiographer-physician or service fulfilling standards of practice guidelines.

If studies are performed by echocardiographers or laboratories not complying with "Guidelines for SPPE," then reports should indicate the need for paediatric cardiac review.

Laboratories performing studies in this way should establish formal relationships with a major paediatric echocardiographic centre.

### **Congenital Heart Disease in the Adolescent and Adult**

Echocardiographer-physicians and echocardiography services undertaking studies of these patients will generally require knowledge of congenital heart disease comparable to that of the "paediatric echocardiographer." Reporting requirements and requirements of the examination will also be similar to those noted above, although limited echocardiographic windows may compromise the information obtained. In this situation transoesophageal study by suitably trained echocardiographer-physicians should be considered when clinically indicated.

### **Fetal Echocardiography**

Fetal echocardiography is a highly specialised area within paediatric echocardiography and should not be undertaken by those without special training and interest in this area and who do not have an extensive ongoing continual exposure.

## **Summary**

Guidelines for paediatric echocardiography and the study of congenital heart disease have been designed to assist echocardiographer-physicians and echocardiography practices when determining how such studies should be conducted and the standards against which such studies should be judged.

## **APPENDIX I**

### **Sedation for Paediatric Echocardiography**

1. Protocols for sedation should be available.
2. In general sedation may be required for infants from 6 months to children 3 years. There are greater hazards and demands for monitoring in infants less than 6 months. Conventional sedation is often ineffective in children over 3 years.
3. Medications should be charted and administered by a medical practitioner or nurse.
4. Explanation of the medication and side effects should be available to families.
5. Monitoring of oximetry and heart rate should be accessible.
6. No child should be sent home if he or she is too drowsy to reliably maintain a patent airway.
7. Sedation doses must be modified for children with cyanosis, those with congestive cardiac failure, those at high risk of upper airway obstruction and those with intercurrent illnesses.

### **Footnote:**

These Guidelines have been devised by the Cardiac Society of Australia and New Zealand and ASUM is grateful for its permission to include them in our Policies and Statements Folder. Certain small changes have been incorporated to allow for ASUM definitions regarding sonographer-technicians.