ECHO GUIDELINES

Guidelines for Paediatric Echocardiography in South Africa

The Paediatric Cardiac Society of South Africa

A statement from the the Paediatric Cardiac Society of South Africa, a special interest group of the South African Heart Association.

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INTRODUCTION

This document provides guidelines for standards of practice in paediatric transthoracic echocardiography in South Africa. Paediatric echocardiography is not a substitute for a proper clinical opinion and such studies are best performed as part of an assessment by a paediatric cardiologist.

PATIENTS

While this document refers to 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 be best assessed by echocardiographers and cardiac services with capabilities outlined in this document.

PAEDIATRIC ECHOCARDIOGRAPHER-PHYSICIAN

Due to the complex nature of congenital heart disease, paediatric echocardiography should be performed by a paediatric cardiologist, or under the supervision of a paediatric cardiologist. However, the services of a paediatric cardiologist may not always be available, or the need for evaluations may be overwhelming. Under these circumstances, physicians who have received appropriate training in paediatric echocardiography may perform such echocardiograms.

Minimum training and knowledge would include:

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 which 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. The previous completion of 500 self-conducted paediatric echocardiographic studies (at least 400 with congenital or acquired heart disease) with the production of a provisional report, which will have been checked by a paediatric cardiologist.
8. Performance of at least an additional 500 paediatric echocardiographic studies (at least 400 with congenital or acquired heart disease) in conjunction with and under the supervision of a paediatric cardiologist.

PAEDIATRIC SONOGRAPHER-TECHNOLOGIST

A paediatric sonographer-technologist 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 sonographer-technologist should work under the supervision of a paediatric cardiologist.

ONGOING EXPOSURE

Paediatric cardiologists and other paediatric echocardiographer-physicians 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 and color flow mapping.

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 in centers with a paediatric cardiology service.

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

This should be considered of highest priority in paediatric echo-cardiography studies and equipment providing optimal performance in this area is required.

Colour Flow Mapping

This is considered essential for a complete paediatric assessment.

Doppler

Pulsed and continuous wave Doppler is also essential for paediatric echocardiographic studies.

Recording

Each study should include standard paediatric echocardiographic views and sweeps and should be recorded on suitable archiving media.

Storage

The requirements of the Health Professions Council of South Africa for storage of medical data in South Africa apply.

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 focused 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 (e.g. 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.

Duration of Study

An average of 50 minutes of paediatric echocardiographer-physician time is required involving performance or partial or complete supervision of a full 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.

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 that 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

Centers & echocardiographer-physicians that cannot meet the above criteria

In some centers, especially outside major cities, 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 echo-cardiographers or laboratories not complying with the guidelines then:

1. Reports should indicate the need for a paediatric cardiac review.

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

Paediatric Sonographer-technologists that cannot meet the above criteria

Due to the nature of cardiac disease in children it is appropriate that paediatric sonographer–technologists should perform paediatric echocardiography only under the supervision of a paediatric cardiologist. However, in certain geographic areas outside major centers the paediatric cardiology services may be overwhelmed or unavailable and it may be necessary for paediatric sonographer-technologists to perform studies. Paediatric sonographer-technologists performing studies under these conditions must comply with the following:

1. Clearly state the need for paediatric cardiology review.

2. Ensure that a paediatrician or physician experienced in the care of children is primarily in charge of the patient.

3. Have a formal relationship with a major paediatric echocardiographic center. This would include the facility to review studies and a commitment to maintain and improve the quality of studies performed.

Neonatologst Echocardiographer

Neonatal physicians who perform echocardiograms should meet the above guidelines. In addition, physicians performing studies on neonates should be especially aware of the presentation of congenital heart disease in the neonate and the echocardiographic features of these. A formal relationship must exist with a paediatric cardiac service and a quality assurance program should be in place to ensure that appropriate standards are maintained.

Review by paediatric cardiologist

A review by a paediatric cardiologist should be mandatory when any cardiac surgical intervention is contemplated or the clinical presentation is discordant with the echocardiographic findings.

SUMMARY

The above guidelines are intended to assist echocardiographers and echocardiography practices in determining how paediatric echo-cardiographic studies should be conducted and the standards against which they 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 of 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 cardiac failure, those at high risk of upper airway obstruction and those with intercurrent illnesses.

This document represents the views of the executive committee of the Paediatric Cardiac Society of South Africa. The guideline has been adapted with permission, from the" Guidelines for standards of practice in Paediatric echo-cardiography" of The Cardiac Society of Australia and New Zealand and the Australian Society for Ultrasound in Medicine (www.asum.com.au).