



**ACADEMY OF MEDICINE, SINGAPORE**

**GUIDELINES ON THE USE OF  
ULTRASOUND IN MEDICINE**

**MAY 1995**

**ACADEMY OF MEDICINE, SINGAPORE**  
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# GUIDELINES ON THE USE OF ULTRASOUND IN MEDICINE

## PREAMBLE

The Guidelines of the Academy of Medicine on the Practice of Ultrasound in Medicine are not designed as rules but are an attempt to define the practice principles in ultrasound that should generally produce quality standards. Adherence to these guidelines should produce an acceptable standard in the practice of ultrasound in the different disciplines in medicine.

## AIDE-MEMOIRE

This document sets out to define the current minimum standards in the practice of ultrasound in medicine. Adherence to the recommendations should assure an adequate high quality in the practice of ultrasound in medicine. The practitioners are expected to maintain standards with appropriate continuing education, training, and practice in the modality of medical ultrasound.

These guidelines will be reviewed regularly.

Attention of practitioners is drawn to the requirements and penalties governing their possession of ultrasound equipment as set out in the Radiation Protection Act 1991.

Since ultrasound is practised in many disciplines in medicine, the aim here is not to attempt to define a general standard for all

disciplines, as each discipline will have its own requirements. This document therefore contains two sections, as follows:

## Section I – General Guidelines

General Guidelines are defined with regard to the following parts:

Part A Equipment and Documentation

Part B Examination, including experience of the practitioner (medical doctor or medical technologist), training requirements, and examination standards.

## Section II – Specific Guidelines for Each Discipline

The list of guidelines in Section II presently are drawn up by the following Chapters of the Academy of Medicine:

- i) Chapter of Radiologists
- ii) Chapter of Obstetricians & Gynaecologists
- iii) Chapter of Physicians
- iv) Chapter of Paediatricians.

## SECTION I – GENERAL GUIDELINES

The following recommendations are aimed at providing assistance to the practitioner performing ultrasound. This section is comprised of two parts:

- Part A Equipment and Documentation
- Part B Examination.

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## **PART A**

### **EQUIPMENT**

Ultrasound study should be conducted with a real-time scanner. The transducer used should be of appropriate frequency and power in relation to the requirements of the particular examinations.

### **Care of Equipment**

All probes should be cleaned after use. The type of solution and amount of cleaning time depends on the manufacturer and also on the recommendations of infection control committee. In the case of intracavity examination, when protective sheaths are used, they should be disposed off and the probe be cleaned in an antiseptic solution.

### **DOCUMENTATION**

Adequate documentation is essential for high quality patient care. There should be a permanent record of the ultrasound examination and its interpretation. Images of all abnormalities reported should be recorded in hard copy. Normalities should be recorded (hard copy being optional). Variations from normal size should be accompanied by measurements. Images are to be appropriately labelled with the examination date, facility name, patient identification, image orientation and, whenever possible, the organ or area imaged. A report of the ultrasound findings should be included in the patient's medical record.

## **PART B**

### **EXAMINATION**

#### **1) Experience of the Practitioner**

The practitioner must be a qualified medical doctor or a medical technologist trained in ultrasound scanning.

Apart from the medical operators who must be qualified to perform the examinations, the paramedical personnel (technician) must be supervised by the medical doctors.

#### **2) Training Requirements**

A practitioner must be suitably qualified to perform and interpret ultrasound examinations, and this will be evidenced by either documentation or certification from the relevant training centre or academic body. These practitioners would normally, as a general rule, have at least six months' experience in the practice of ultrasound.

(Please see the specific guidelines on experience of operators in Section II of the respective discipline).

Practitioners are encouraged to attend continuing medical education programmes which may include refresher courses and hands-on training.

#### **3) Examination Standard**

Guidelines relating to the standard of ultrasound examination performed on each organ and anatomical region are described in Section II as performed under each specific discipline.

## SECTION II – SPECIFIC

### PART A – RADIOLOGY

#### GENERAL GUIDELINES

1. All diagnostic ultrasound examinations should be conducted at the request of, or on behalf of, a registered medical practitioner.
2. Ultrasound services should be provided only by those medical practitioners who have competence in the specific examinations they undertake either personally or for which they are responsible.
3. Where radiographers/sonographers are employed to conduct the ultrasound examination,
  - i) The medical practitioner should ensure that the sonographer is appropriately qualified and competent with a DCR diploma or an equivalent (and with ultrasound certification such as DDU diploma). If the latter is not available, at least 6 months of documented full-time training in other relevant specialised imaging departments is required. On no account are nurses, biotechnologists or other non-imaging qualified personnel allowed to conduct ultrasound examination.
  - ii) The medical practitioner should be available for advice and be capable of extending the examination, where appropriate.
  - iii) The level of direct supervision of the sonographer by the medical practitioner should be appropriate for the training and experience of the sonographer.

iv) Sonographers must not practise independently of medical practitioners.

4. The radiologists in charge of the ultrasound service has overall clinical responsibility for providing this service including the appropriate instruction and supervision of the radiographers.

#### TRAINING GUIDELINES

A medical practitioner must be suitably qualified to perform, interpret and supervise ultrasound examinations.

Adequate training and qualification for the performance of ultrasound examinations will be evidenced by obtaining the FRCR, FRACR or American Board Certification in Diagnostic Radiology or appropriate post-graduate diagnostic radiology qualification. All these specialist qualifications incorporate substantial training of at least 6 months in diagnostic ultrasound.

#### EQUIPMENT GUIDELINES

1. Abdominal and retroperitoneal studies should be conducted with real-time scanners, preferably using sector or curved linear transducers. Obstetric and female pelvic studies should be conducted also with real-time scanners using an abdominal and/or vaginal approach.

Static scanners should not be used.

The transducer should be adjusted to operate at the lowest possible ultrasonic settings to gain the necessary diagnostic information. With modern equipment, these frequencies are usually between 2.25 and 5.0 mHz.

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## 2. Care of equipment

All probes should be cleaned after use. Vaginal probes should be covered by a protective sheath prior to insertion.

Following the examination, the sheath should be discarded and the probe cleaned in an antimicrobial solution. The type of solution and amount of time for cleaning depends on the manufacturer and infectious disease recommendations.

## 3. Quality Assurance

Ultrasound equipment must be regularly serviced and maintained and a service contract with the manufacturer or other qualified provider should be entered into.

## 4. Ethical Responsibilities on Ownership of Ultrasound Equipment

The equipment should not be used to generate unnecessary demand, either to recover costs or as an object for enhancing underserved profits. Ultrasound examinations should only be performed when clinically indicated and not repeated unnecessarily. Medical practitioners who own their own ultrasound equipment must be aware of the tendency for self-referral and to over utilise their equipment as well as over-charge for these examinations.

## DOCUMENTATION OF ULTRASOUND EXAMINATIONS

1. Adequate documentation is essential for high quality patient care.
2. A register of ultrasound examinations performed including clinical indications for the study should be kept by each

medical practice.

3. There must be a permanent record of the ultrasound examinations and its interpretation. Imaging of all appropriate areas, both normal and abnormal, should be recorded in an imaging or storage format. Images are to be appropriately labelled with the examination date, patient identification, body parts examined.
4. A written and signed report should be issued on all ultrasound examinations by the responsible medical practitioner and should be made available immediately if necessary. When the radiologist does the examination, he will issue and sign the report himself. The radiologist may issue a report on an examination performed to his satisfaction by a qualified radiographer.
5. Radiographers may not issue medical reports but may record physiological measurements.

## QUALITY ASSURANCE

To maintain adequate quality of examination aside from the adequate technical performance of the equipment, personal performance of both medical practitioners and radiographers depends on the maintenance of appropriate standards of training and current awareness.

1. Specialists in diagnostic ultrasound should collaborate in undergraduate and postgraduate education and in the continuing education of other medical practitioners and sonographers.
2. Medical practitioners performing ultrasound should have documented attendance of at least 6 hours of lectures on diagnostic ultrasound or attendance at radiological clinical conference or other meetings in hospitals or other institutions per annum.

## **PART B OBSTETRICS & GYNAECOLOGY**

### **PREAMBLE**

The implementation of these guidelines is aimed at maintaining a consistent practice by those who perform obstetrical and gynaecological ultrasound scans.

Ultrasound is accepted as a standard tool in the practice of Obstetrics & Gynaecology to gain more information. The majority of obstetric ultrasound is not done for morphology abnormality scan. Whilst accepting that ultrasound is useful, there are also limitations. It is accepted that not all fetal anatomy at any time can be fully assessed. (See Annex on 'Limitations')

It is imperative that all personnel concerned should be trained before performing ultrasound scans for their patients on a service basis.

### **QUALIFICATIONS OF OPERATOR**

The operator must be a qualified doctor or paramedical personnel trained in ultrasound scans appropriate for the type of scans performed for their patients.

Trained medical and paramedical personnel who are currently practising it may continue to do so. However, they are encouraged to attend continuing medical education (CME) programmes.

### **PROFESSIONAL RESPONSIBILITIES**

- 1) The person performing the ultrasound scan for a patient should record the findings and initialise the report.

- 2) Where paramedical personnel are employed to conduct the O & G ultrasound examinations.

- 2.1 The employer should ensure that they are suitably trained.
- 2.2 Registered medical practitioners should be available for advice in the management of the patient undergoing the ultrasound scan.
- 3) The sonographers must not practise independently of registered medical practitioners.
- 4) All ultrasound scans must be performed with indications.

### **TYPES OF O & G ULTRASOUND SCANS**

The various types of O & G ultrasound scans are spelt out in the Annex.

### **TRAINING REQUIREMENTS**

1. Medical and paramedical personnel performing O & G ultrasound are encouraged to attend CME programmes which may include refresher lectures and hands-on training.
2. Medical and paramedical personnel who are starting to perform O & G ultrasound scans are urged to complete the following training programmes.

#### **1) Theoretical training**

A series of co-lectures which covers the following topics:

- Physics of ultrasound, equipment and safety
- First trimester ultrasound
- Biometry

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- Systemic ultrasound scanning
- CNS/Head & Neck
- CVS
- GIT
- Renal/Skeletal System
- IUGR Assessment and AFI
- Doppler Blood Flow measurements
- General gynaecological scan.

## 2) Practical Training

The ultrasound scans would ideally be performed under hands-on supervision during this practical training.

Types	Minimum achieved
First trimester	50 cases
Dating/Interval growth	50 cases
Morphological Screening Scan	50 cases
Gynaecological Scan	50 cases.

## 3) Further Training (if desired) Detailed Morphological Study

As per RCOG/RCR Joint Committee Guidelines (300 hours in 100 sessions for a period of more than 6 months and less than 2 years).

## DOCUMENTATION

1. All scans performed would be adequately documented in a report for the type of scan done.
2. It may be helpful to have a register of these scans performed by the owner of the ultrasound scanning machine, which may include the patients' name, identification numbers, clinical

indications and the type of ultrasound scan performed.

3. Any peculiar circumstances or limitations encountered during the process of performing the ultrasound scans should be stated in the report as well.

## EQUIPMENT GUIDELINES

It shall be the responsibility of the owner of the ultrasound scanner that the machines be optimally maintained. Special attention should be given to the sanitary aspects in the maintenance of the probes (especially vaginal probes) so as to avoid cross transmission of infectious diseases between patients.

### Abbreviations:

<b>CNS</b>	<i>Central Nervous System</i>
<b>CVS</b>	<i>Cardiovascular System</i>
<b>GIT</b>	<i>Gastrointestinal Tract</i>
<b>IUGR</b>	<i>Intra-uterine Growth Retardation</i>
<b>AFI</b>	<i>Amniotic Fluid Index</i>
<b>RCOG</b>	<i>Royal College of Obstetricians &amp; Gynaecologists</i>
<b>RCR</b>	<i>Royal College of Radiologists</i>

## LIMITATIONS IN OBSTETRICS & GYNAECOLOGICAL ULTRASOUND SCANS

The limitations in ultrasound diagnosis would be explained to the patient.

- a) It is understood that scanning conditions are often not ideal. Visualisation of morphological details can be extremely difficult in some cases in the presence of one or more of the following: obesity, abdominal scars, twins, inappropriate fetal lie or position, reduced liquor volume, scanning before 18 weeks and after 28 weeks, other constraints.
- b) Even in the best of hands, up to 30% of abnormalities can be missed.
- c) A normal scan does not necessarily mean a normal outcome and vice-versa.
- e) Moreover, it is understood that even an infant who looks normal may not develop normally.
- f) Gynaecological findings may not correlate with clinical and/or operative findings.

## TYPES OF OBSTETRICS & GYNAECOLOGICAL ULTRASOUND SCANS

### 1st Trimester Scans

Scanning in the first trimester may be performed either abdominally or vaginally.

The following should be sought for and documented:

1. The location of the gestational sac.
2. The crown-rump length.
3. Presence or absence of fetal life.
4. Fetal number.
5. Evaluation of the uterus and adnexal structures.

### Dating of Pregnancy

1. Ultrasound scan performed to date a pregnancy is most preferably done before 20 weeks of gestation.
2. Dating may be based on the following measurements as appropriate to the gestation of the fetus:
  - crown-rump length (CRL)
  - biparietal diameter (BPD)
  - head circumference (HC)
  - femur length (FL).

### Interval Growth Scan

1. The assessment of fetal growth is performed with an interval of 2 to 3 weeks between two scans.
2. The fetal biometry most commonly used to assess fetal growth includes:
  - head circumference
  - abdominal circumference
  - femur length.

### Fetal Morphology Screening Scan

1. This scan may be performed between 18 and 22 weeks of gestation.

## ANNEX

### LIMITATIONS IN OBSTETRICS & GYNAECOLOGICAL ULTRASOUND SCANS

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2. This scan may, under optimal conditions identify all the following structures:

- intracranial structures including the ventricles, cerebellum
- heart including the 4-chambers view
- thorax and lungs
- stomach
- kidneys
- bladder
- cord insertion
- fetal upper and lower limbs
- fetal spine
- fetal biometry including the HC, AC & FL.

#### **Confirmation of fetal presentation and lie**

1. This scan is usually performed near the time of delivery, when physical examination is uncertain.
2. It may include:
  - fetal presentation
  - fetal lie (longitudinal, transverse, oblique).

#### **Placental Localisation**

1. This scan is usually performed when a patient presents with malpresentation or antepartum haemorrhage.
2. The following should be identified:
  - the location of the placenta with relation to the uterine wall
  - the relation of the placenta to the cervical os
  - any abnormalities or variation of placenta.

#### **Amniotic Fluid Index**

AFI is the sum of the largest vertical depths of liquor pockets in each of the 4 quadrants of the uterus (as defined by the midline and a horizontal line half way between the symphysis pubis and the uterine fundus).

#### **General Gynaecological Scan**

All relevant structures mentioned should be identified as far as possible using abdominal and/or vaginal approach. Structure(s) not visualised should be stated as such. Familiarity with pelvic structures/anatomy is a recommended requisite.

##### **a) Uterus**

To document any abnormality seen in respect to its size, shape and contour, orientation in the cavity and unusual masses.

##### **b) Adnexa (ovaries and fallopian tubes)**

Ovaries should be identified whenever possible and to document abnormalities in respect to its size, shape and contour and echogenicity.

Tubular echolucent structure(s) or adnexal mixed echo mass(es) other than the ovaries should be documented and described if present.

Follicular tracking could be undertaken if necessary.

##### **c) Cul de sac**

Free fluid or mass(es) if present should be documented and described if necessary.

**d) Vagina**

This should be identified and any abnormality documented.

**PART C INTERNAL MEDICINE**

**PREAMBLE**

The specialties covered under these guidelines include Gastroenterology, Nephrology, Endocrinology and Neurology. Cardiology has been dealt with separately.

**TRAINING REQUIREMENTS**

The basic training for a qualified physician comprises at least 2 weeks' full-time training, or its equivalent in hours of part-time training, carried out in a recognised training programme in ultrasonography. After the basic training, the physician is required to perform and interpret ultrasound on at least 200 patients under close supervision and tutoring.

Physicians intending to undergo training in ultrasonography are advised to submit to Chapter of Physicians particulars of their training programme for advice, record and possible recognition.

Standards of operators shall be maintained through peer review of qualified specialists once in 2 years.

**EQUIPMENT REQUIREMENTS**

Minimal requirements of equipment as well as good working order are of great importance in interpretation and accuracy of results. The equipment may be subject to peer inspection.

**DOCUMENTATION**

Every ultrasound examination shall be accompanied by proper patient's record and signed report of sufficient details with recorded images.

**d) Vagina**

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## **PART D PAEDIATRICS**

### **GENERAL**

1. The practitioner must have obtained an approved postgraduate qualification in Paediatrics and worked in a neonatal department or a paediatric unit for at least 1.5 to 2 years.
2. He shall have operated ultrasound machine(s) under supervision of an experienced senior for at least 6 months. During this period of supervision, ultrasound of the brain, kidneys and liver should be performed under guidance.
3. The practitioner must be able to perform ultrasonography and interpret the images with an acceptable degree of accuracy for at least 100 cases and perform follow-up ultrasonography on those findings to observe and track the progress of lesions.
4. At the end of the training period, he should be certified by the superior officer to be competent in ultrasonography.

### **GUIDELINES FOR TRAINING IN PAEDIATRIC ECHOCARDIOGRAPHY**

#### **Basic Training**

1. Knowledge and understanding of acoustic and technical principles of ultrasound instrumentation and its proper and safe use.
2. Knowledge of anatomy, physiology, hemodynamics and pathology of congenital and acquired heart disease.
3. Understand the proper applications and limits of the various modalities of echocardiography (m-mode, 2 dimensional, pulses, continuous wave and colour doppler).

4. Knowledge of clinical paediatric cardiology so that one can correlate the echocardiographic finding with the clinical picture.

#### **Level of Training**

1. Need close supervision of laboratory director.  
3 months in echocardiographic laboratory performing at least 200 complete echocardiographic studies, half of which are done in children less than 1 year of age.
2. Act independently with minimal supervision of laboratory direction.  
Additional 6 months in an echocardiographic laboratory performing at least 400 complete echocardiographic studies, half of which are done in children less than 1 year of age.
3. Able to perform independently  
Additional (to 1 and 2) 12 months in an echocardiographic laboratory performing at least 750 echocardiographic studies. During this period, the competence of the trainee should be assessed by the laboratory director in areas of understanding and interpretation of the echocardiographic findings and its correlation with the clinical status of the patient.

#### **Site of Training**

The place of training should be in an established paediatric echocardiographic laboratory under the direction of a full-time paediatric cardiology echocardiographer. The centre should be located in an active paediatric cardiology centre with both in and out patient services, neonatal and paediatric intensive care, cardiac catheterisation/angiography laboratory, and paediatric cardiothoracic surgical centre.

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