

(Med V)

INTRODUCTION TO PERINATAL ULTRASOUND

(Read in small doses)

Ultrasound has been used for obstetric imaging for over 30 years, with immensely rapid advances in resolution over the last 10 years; some of the following comments may not be valid in a year's time.

OBJECTIVES: to understand the place of ultrasound in obstetric, neonatal and gynaecological management.

: to recognise the limitations of ultrasound.

To achieve objectives:

- i) notes
- ii) observe an ultrasound scan being performed (preferably 19 weeks.)
(note the response of the parents.)
- iii) introductory video is available in U/S Department and library.
- iv) Tutorials are conducted on Wednesdays at 4 pm in the Radiology Conference Room, 2nd Floor Rogerson Bld. from week 2-7. Some teaching films are kept on the multiviewer in the corridor outside the X-ray reporting room.
- v) read the patient information sheets on "The 19-20 week Scan" and "Testing for Birth Defects in Pregnancy."

SOME ASPECTS OF PHYSICS

A beam of ultrasound transmitted through the body will be partly reflected at an interface between 2 tissues of different acoustic impedance (in simplistic terms, where there is a change in texture). If the reflected beam travels on roughly the same path as the original beam, it will be detected by the transducer (receiver/transmitter), and will be represented on the machine-generated image as a white spot on a black background. The stronger the received reflection, the brighter the white spot.

Thus, an interface between adjacent tissues of identical acoustic impedance will not be imaged. Although a collection of clear fluid appears black (sonolucent, anechoic), a similar appearance can be due to a very homogeneous tissue - no change in texture, no echoes. A well-known trap is to mistake a mass of lymphomatous nodes for an aortic aneurysm. Unlike on x-rays, a very white area (echogenic or hyperechoic) does not necessarily represent a very dense tissue - both air and bone adjacent to soft tissue produce almost total reflection. Therefore, ultrasound doesn't 'see' past lung or air-containing bowel, and an ultrasound of an infant's head is of very little value once the window of the fontanelle closes. Fat is also limiting to image quality.

An interface producing total reflection will cause a black line to appear on the image downstream from the white spot representing the interface (because no information is available from this area). This shadowing is useful for identifying gallstones, teeth in dermoids etc.

Tissues also absorb sound to varying degrees. Downstream from a poorly-absorbing tissue (e.g. fluid), the image will be brighter than in adjacent areas at the same depth. This acoustic enhancement from trans-sonic tissues is useful for tissue characterization (e.g. identification of a cyst), and to provide 'windows' to deep structures (bladder for uterus, stomach for pancreas).

Tissue characterization by ultrasound is quite limited at present. Certain viscera can be recognized by a characteristic echo pattern - uniform speckling of liver and spleen, kidney with anechoic pyramids and echogenic central complex. Some dermoids are easily identified via teeth, hair/fat 'fluid level' - but others are indistinguishable from bowel loops. (If a palpable mass is invisible on U/S, it is worth an x-ray). U/S does not provide a tissue diagnosis of a gynaecological mass.

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An interface will not be represented on the image if the reflected beam from it does not reach the transducer. Therefore, if the fetus is lying OA or OP, the falx is nearly parallel the beam, and may be 'invisible' - hence the report "An accurate B.P.D. (biparietal diameter) could not be obtained, due to the fetal position". (The falx must be seen clearly, to be sure that the plane of the scan is not oblique.)

On the screen, the images are moving - immensely useful e.g. for identifying bowel loops via peristalsis, or an ectopic pregnancy via fetal heartbeat. It can also make an antenatal scan a joyful occasion for parents, with a real contribution to bonding. It provides great flexibility for the scanner, but there is no standard notification to orientate the resulting pictures.

Longitudinal images are recorded with the patient's head to the observer's left (look for maternal bladder). Transverse scans (like XR's) place the patient's right on the observer's left - like standing by the patient's bed, looking upwards from below. (Look for the symmetry of the abdominal wall.)

Safety. There has been no reproducible evidence of damage to human tissues at the intensities and duration used for diagnostic ultrasound. Nevertheless it should be considered as x-rays and therapeutic measures are: valuable if used appropriately, but should not be misused. When you request an ultrasound, is it going to alter your management? Scans because the parents want to look at the fetus or know its gender are not appropriate, in terms of safety, nor an acceptable use of the limited health funding. Nor is it acceptable to use ultrasound as a pregnancy test. Every unnecessary scan takes funds away from areas where they are needed. 3D is still experimental, and we are not using it on normal pregnancies.

FIRST TRIMESTER

PV Bleeding/Abdominal Pain

1st trimester: interpretation may require reasonably accurate dates (how long ago was the pregnancy test positive?) and a current B-HCG. With a sac less than 6½ weeks size, if there is uncertainty, give the pregnancy the benefit of the doubt, and rescan after at least a week: a heartbeat should be identifiable by then. An intra-uterine pregnancy effectively excludes an ectopic - but beware Clomid etc. Vaginal transducers allow earlier diagnosis, and do not require a full bladder but should be done in conjunction with abdominal scanning unless the patient is fasting. By transvaginal scan, a yolk sac is usually visible at 5+ weeks, and a fetal heart by 5½. We assume the pregnancy test is positive at 3 weeks from a hypothetical LMP.

Significant B-HCG + empty uterus = laparoscopy for ectopic. Classical signs of an ectopic occur late (free fluid, adnexal mass ± heartbeat); you cannot afford to wait until ultrasound shows an ectopic. The purpose of the scan is not to show an ectopic, but to see whether there is a definite pregnancy in the uterus. If the HCG is greater than 2000, a sac should be visible.

Reassurance scans for asymptomatic patients with previous miscarriages should be deferred till about 8-9 weeks - earlier scans are like selling fool's gold.

Localisation of pregnancy if there is a past history of ectopic or tubal surgery: likely to be equivocal if done too early. Decidual reaction and fluid in the uterus can produce a confusing 'pseudosac'. You can't assume that something in the uterus is a pregnancy unless it contains a yolk sac or fetal heartbeat or fetal pole. If the patient is asymptomatic, 5½ weeks is the earliest for localization scan, if there is a PH of ectopic or tubal surgery (by transvaginal scan).

Estimation of dates before 19 weeks. (Booking scans are routine in some hospitals but not at present at W.C.H).

- In patients requesting termination.
- In fetuses at risk of familial dwarfism.
- Uncertain dates; to plan -C.V.S. or Amnio or serum screening for Down's.

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Hyperemesis. The pickup rate of twins or moles on scans for this condition is vanishingly small - restrict scans to patients sick enough to need admission to hospital (for reassurance).

SECOND TRIMESTER:

MORPHOLOGY SCAN ("ROUTINE") - most patients in Australia have this scan.

The timing of the scan is a compromise between the requirements of accurate dating and an adequate assessment of fetal morphology: optimally 19-20 weeks (later than this gives too little leeway for a second look or second opinion if there is an abnormality warranting termination). Ultrasound does not exclude fetal abnormality, particularly of heart and face. If a significant fetal abnormality is found, arrange multi-disciplinary discussion; (e.g. at W.C.H. ADACS meeting) Karyotype for 1 major or 2 minor abnormalities, as soon as practicable. Maternal age influences counselling. Counselling should be non-directive and repeated. The parents need at least 24 hours to make a decision about continuing the pregnancy, to allow normal grieving processes.

Fetal size follows Gaussian distribution, with a widening range of normal as pregnancy advances. A scan in late pregnancy therefore doesn't 'confirm dates'.

Gestation - important to AFP assessment, assessment of growth, timing of delivery.

Accuracy of age estimation

Best - IVF/GIFT/clomiphene (IVF implantation date is taken as day 17).

1st trimester scan - crown-rump length $\pm \frac{1}{2}$ week

2nd trimester scan - average BPD/femur, ± 1 week

Patient's dates

Worst - 3rd trimester scan - nearly useless for dating; ± 3 weeks

If the first scan is within normal limits for dates, we accept the dates as correct. If not, we re-date on the basis of that scan. Repeat scans do not change the estimated dates.

The femur length is used in 2nd trimester to screen for lethal short-limb dwarfisms.

- A. Fetal** - viability, number, morphology (see checklist), size
- B. Uterine** - shape - duplication not often recognized
 - masses
 - cervical canal closed?
- C. Liquor volume** - relative maximum around 28 weeks - rapid decrease after 37.
- D. Placental site** - Considerable 'migration' occurs as the uterus enlarges. A placenta covering the os in 2nd trimester merits a repeat scan around 32-34 weeks. A placenta reaching the os from the side can be hard to visualize. The placenta is more echogenic than uterine wall, with bright line along the amniotic surface.
- E. Adnexal masses**, especially those which might obstruct labour.

Disadvantages

- Cost to patient and community (\$100+ scan).
- Parental anxiety, if abnormality or normal variant or red herring is discovered.

THIRD TRIMESTER

Fetal Growth and Well Being

Fetal size depends on age and growth rate; you need to know age to assess growth rate; or to assume that growth rate is normal, to estimate age. Growth has three components;

- Brain growth, assess by head size especially B.P.D.
- Visceral growth, especially liver, assessed via abdominal measurements.
- skeletal, usually assessed by femur length.

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IUGR - avoid the full word 'retardation' where patients can hear or read it. The lability of the gravid psyche should not be underestimated - female or male!

Doppler has a role in high risk pregnancies but evidence does not support routine use in normal pregnancy. Some departments assess a Biophysical Profile, or anatomical features, to assess fetal wellbeing.

Serial scans are done in high-risk pregnancies (Maternal lupus, hypertension, renal disease, IDDM; IUGR, multiple pregnancy, oligohydramnios.)

The slope of the growth curve matters more than a single abnormal measurement. A fetus growing parallel the median curve probably isn't under stress at the moment. Early growth retardation carries risk of long term sequelae (learning difficulties etc.) Late onset growth retardation is more likely to be associated with fetal distress in labour and perinatal mortality. Weight estimates are rough guides only and should not precipitate delivery. It is not worth scanning more often than fortnightly for growth. Cervical incompetence . If the length is less than 2.5 cms, there is increased likelihood of delivery before 32 weeks.

Multiple Pregnancy - Establish type of twinning
(Chorionicity/amnionicity is best assessed early.)

Scan approximately 3-weekly from approximately 26 weeks, looking for growth, signs of compromise or twin-twin transfusion.

↑ Risk of fetal abnormality.

Loss of one or more sacs before 12 weeks is common.

Twin-Twin Transfusion

All monochorionic placentas have anastomoses between the two circulations.

Monochorionic only.

Increased incidence of cerebral palsy.

Can stop spontaneously.

Mild/Chronic - discrepancy in size of twins (more commonly due to IUGR in one)

Moderate - either may -> heart failure
(hypervolaemia in recipient [plethoric], anaemia in donor)
- either may succumb

Acute severe - recipient -> polyuria (large bladder), polyhydramnios
- donor -> empty bladder, oligohydramnios
- often precipitates labour
- treatment; repeated drainage of liquor, or laser separation of the placental anastomoses (available in Brisbane and Sydney: possibly less CP, but longterm studies are in progress).

Death of one of monozygotic twins can → surviving twin syndrome – (3rd trimester) – probably due to exsanguination of survivor via the anastomoses at the time of the death of the other. Can have profound neurological sequelae.

Monoamniotic

- usually overdiagnosed
- ↑ risk of abnormality (specifically, conjoint)
- high risk of fetal loss (cord entanglement occurs in all).

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Pain/Bleeding

placental site can be localised with good (not 100% accuracy.) Ultrasound does not show abruptions unless they are very large, and may not be able to differentiate between retroplacental clot and a degenerating fibroid. The maternal gall bladder and kidneys are readily added to the scan. Perineal scanning (in some departments, transvaginal) may clarify the placental site if it is not well seen. With an anterior placenta praevia, it is crucial to write on the request form that there has been a previous section/s (risk of accreta).

Oligohydramnios/Polyhydramnios

Eyeball assessment is as good as Amniotic Fluid Index or Deepest Pool measurement.

↑ Risk of fetal abnormality. Visualization will be poor if there is little liquor.

Longstanding ruptured membranes - lung growth may be compromised.

Amnioinfusion (mainly 2nd trimester) can be used to improve fetal visualisation, and to Confirm SRM. Its therapeutic potential is unproven.

Suspected IUFD/abnormal fetal movements

We do not look for cord around the neck as ultrasound is neither predictive nor reassuring..

Threatened Premature Labour

Dilatation of cervical canal. Fetal weight, presentation, morphology, placental site.

Iso-immunization. Signs of heart failure, but ultrasound is not reliable, especially if the onset of anaemia is gradual. Umbilical artery Doppler is useless. Middle cerebral artery Doppler is promising.

Site for amniocentesis, chorionic villus sampling, follicle harvesting. Cord blood sampling (for genetic diagnosis, Hb in iso-immunisation), intra-uterine transfusion, catheter drainage of obstructed fetal urinary tract (unproven benefit).

Fetal presentation, if doubt exists. Position of legs and attitude of head in breech position. ? underlying cause of malpresentation.

If the patient has had a scan elsewhere within the last week, obtain the previous report (this should always be possible by phone or fax or by OACIS) and/or discuss the films with the radiologist before you consider re-scanning.

GYNAE

The LMP is **essential** information in Gynae as well as Obstetrics, to judge endometrial and ovarian activity.

Pelvic masses. Therapeutic needle drainage of recurrent cysts, post-op abscesses. Diagnostic aspiration of ovarian masses is considered contra-indicated by most workers (risk of seeding, sampling wrong area). Atypical gynae masses are best scanned both trans-abdominally and trans-vaginally. Many gynae masses are nonspecific/similar in appearance.

Most ovarian masses under 5 cm in the reproductive age-group will disappear if given a chance. Rescan at a different stage of the cycle, say in 6 weeks, unless there are reasons to do otherwise. Don't use the word "cyst" for physiological structures - it frightens the patient. Transvaginal scanning supplements, but is not adequate to replace trans-abdominal. Scans are also done for polycystic ovaries, pelvic pain, abnormal or postmenopausal bleeding.

Lost IUCD - ? in the uterine cavity. If it is not seen, a full AXR is needed (non-pregnant.)

Sono-HSG: TV scan after putting fluid in the endometrial cavity: for polyps, submucosal myomas, synechia. Only if TV scan has shown a relevant finding. 3D is promising to assess uterine developmental anomalies.

Pelvimetry Currently done by CT. The value of pelvimetry is questionable.

The child is not a small adult
The fetus is not a small child.

To comment on a scan. Is the patient pregnant? Is the pregnancy in the uterus? Which trimester? How many fetuses? Presentation? Liquor? Placental site? Adnexal masses/fluid? Obvious fetal abnormality?

Roughly - If you see all the baby in the picture, it's first trimester; if there's good detail, it's second; if abdo or head takes up most of the picture, it's 3rd.
If there's room for another fetus, there's polyhydramnios. If the detail is terrible, check that there are pools of liquor.

Views of the fetus are not necessarily in standard anatomical planes, and are not in standard orientation. Look for the spine, ribs, iliac wings to orientate a picture. Views taken in longitudinal or transverse section of the uterus will have written or pictorial annotation.

HIGH A.F.P. - COMMONER CAUSES

Normal
Wrong dates
Twins
Fetal death or incipient fetal death, dead twin
Haematoma
Fetal abnormality involving an area of absence of skin
- neural tube defect
- anterior abdominal wall defect
Many others, mostly rare, including placental tumour (chorioangioma).
Extremely high - tumours of maternal ovary or liver (very rare).
Raised AFP: detailed scan.

A high AFP marks an increased risk of perinatal mortality, I.U.G.R., pre-eclampsia. ↑ fetal loss rate even after normal scan

Down's - pickup rate by ultrasound is low. A normal 19 week scan reduces the risk of Down's by about half, i.e. is not good enough to replace amnio in an at-risk patient.
Best markers in second trimester are cardiac abnormalities, and increased thickness of the nuchal skin. Duodenal atresia isn't usually evident until 3rd trimester.
Nuchal translucency measurement at 11-14 weeks + first trimester serum screening is promising but at present the government will not fund it (cost to diagnose 1 extra case is approximately \$175,000).
Every NT scan requested means that some other scan can't be done. Nuchal translucency is increased in a number of aneuploidies, an ever-lengthening list of syndromes (mostly rare), and with cardiac abnormalities. If the NT is increased but karyotype and 19 week scan are normal, the take-home-normal-live-baby rate is 90%. NT screening requires detailed prior counselling. It is not currently available at WCH except for multiple pregnancies.
Non-visualisation of the nasal bone is currently being evaluated.

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INCREASED RISK OF FETAL ABNORMALITY

F.H. or P.H. of fetal abnormality (some)

Twins

Diabetes, especially poorly-controlled insulin-dependent (e.g. caudal regression syndrome, HOCM in late pregnancy and neonate, CHD)

Alcohol abuse, Cocaine/Crack, amphetamines, smoking, poor maternal nutrition, possibly marijuana.

Epilepsy, anti-epilepsy treatment (especially neural tube defect)

Warfarin treatment in first trimester

Some psychotropic medications (Lithium & C.H.D.)

Infections - rubella, CMV, toxoplasmosis, syphilis, varicella-zoster.

Iso-Tretinoin (Vit A derivative for treating acne.)

Maternal lupus may present as fetal heart block or recurrent fetal loss.

Thrombophilias, MTHFR - ↑ risk neural tube defect, gastroschisis.

HYDROPS

= fluid in at least 2 serous spaces or one serous space and oedema or placental oedema.

- blood group incompatibility especially Rhesus
- cardiac abnormality including arrhythmia, cardiac failure of any cause
- infection including parvovirus (which can cause fetal anaemia).
- secondary to "cystic hygroma" (jugular lymphatic obstruction sequence.)
- twin-twin transfusion (anaemia, cardiac failure)
- many syndromes and metabolic conditions
- ↑ risk of pre-eclampsia (the "Mirror Syndrome).

Neural tube defect. Increased risk in subsequent pregnancies of spina bifida, anencephaly, encephalocele; decreased by folate treatment pre and post-conception.

Next pregnancy, scan at 12 weeks (not before) to exclude anencephaly; AFP at 16 weeks; morphology scan at 19 weeks.

Recurrent or familial severe/early IUGR/abruption/pre-eclampsia:

lupus, lupus anticoagulant

hyper-homocystinaemia (treat with folate), various thrombophilic states

Factor V Leiden mutation

Commonest major fetal abnormalities found by ultrasound:

anencephaly, spina bifida (less common now due to folate)

abdominal wall defects (exomphalos, gastroschisis)

"cystic hygroma" (Turner's, Down's, many syndromes)

multiple abnormalities in trisomy 18 or trisomy 13 (both lethal)

renal agenesis

There are many fetal ultrasound findings which are transient or of doubtful significance: if your patient has one, ask an expert, promptly.

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DOPPLER - UMBILICAL ARTERY

Umbilical artery Doppler studies have not fulfilled early expectations in obstetrics; it is important not to over-use it, or to over-react to it. It is not a valid screening test for I.U.G.R.. in the general obstetric population. It assesses the speed of blood flow in systole and diastole; it does not quantify the amount of blood flow through the cord. The early papers reported it in terms of systolic to diastolic ratio (sometimes written as A/B ratio); some departments report pulsatility index (PI). W.C.H. reports only whether there is forward flow, zero flow or reversed flow in diastole. If the placental vascular bed is reduced by placental disease, the resistance to flow increases, and therefore the speed of diastolic blood flow decreases. It should be viewed in the light of other assessments of placental function, and should not in itself determine the time of delivery. It must not be used for reassurance in the face of an abnormal C.T.G.

In late pregnancy, because the placental vascular bed is very large, the umbilical artery Doppler does not become abnormal until a very large percentage of the vascular bed is obliterated. An apparently normal umbilical artery Doppler study therefore has little reassurance value after 37 weeks.

Changes in umbilical artery studies precede C.T.G. changes in patients with I.U.G.R.. or pre-eclampsia, by about 2 weeks, but it is a very crude technique. Like assessment of growth, it is probably not worth doing more often than fortnightly in most cases; if there are major concerns, weekly Doppler studies are reasonable. They should not be requested more often than this without prior consultation with the radiologist.

W.C.H. INDICATIONS

oligohydramnios
I.U.G.R.. demonstrated by ultrasound
pre-eclampsia/PIH
insulin-dependent diabetes
lupus, other serious maternal illness, thrombophilic conditions
mature placental calcification before 36 weeks
multiple pregnancy

We also use it to give some reassurance in cases with previous I.U.F.D., previous severe I.U.G.R., or reduced fetal movements, but the reassurance is not necessarily scientifically valid.

RESULTS: very unsubtle

1. Anywhere in normal range is normal.
2. Normal Doppler and normal liquor with severe I.U.G.R.: karyotype (amnio or cordo.)
3. High systolic : diastolic ratio = increased placental resistance : rescan for growth in 2 weeks (as outpatient unless otherwise indicated.) It is not a cause for alarm.
4. Zero or reversed diastolic flow: ring obstetrician, admit, CTG. Consider steroids, depending on the gestational age, as early delivery is likely.

A mildly small fetus with normal Doppler is probably either constitutionally small, or not in trouble at present.

Zero or reversed diastolic flow increase the likelihood of NEC (and to a lesser extent renal vein thrombosis and pulmonary haemorrhage.)

Uterine artery - In high-risk cases (lupus, previous severe IUGR, recurrent PET, homocystinaemia raised AFP) it may indicate an increased risk of IUGR and PET.

In early pregnancy, there is a dip (“notch”) in the flow velocity at the end of systole. Patients who do not lose this notch by 3rd trimester are at high risk. It has no place in the acute management of pre-eclampsia. In cases of profound IUGR where fetal karyotyping is being contemplated uterine Doppler may indicate that the cause of IUGR is maternal rather than fetal.

Until research projects are completed it should be done only in high-risk pregnancies. Evidence does not support routine use.

Intrafetal vessels. The ratio of blood velocity in the middle cerebral artery to that in the renal is an early marker of stress. (Because selective redistribution of blood towards the head and vital structures, at the expense of the abdomen, occurs in response to placental insufficiency.) It is probably better than umbilical artery Doppler, but not sufficiently better to make a difference to the management at present. Because Doppler has some potential for causing heating of fetal tissues, especially those next to bone, Doppler studies of intrafetal vessels at present should be undertaken only as part of formal echocardiography, or as part of a research project. Doppler of the ductus venosus is promising re indicating when to deliver. MCA Doppler is promising for suspected fetal anaemia.

Ovarian Doppler has potential for screening patients with 1st degree relatives with ovarian cancer. It is not likely to become a valid screening tool for the general population.

Duplex vein Doppler has largely replaced venograms for assessment of suspected DVT. Ultrasound **cannot exclude** DVT's in the calf, but formal venogram is hardly ever done now. If clinical suspicion persists after a "normal" Doppler study, repeat the Doppler after a few days.

NEONATAL ULTRASOUND

Premature infants usually have a head scan on day 2, at 2 weeks, and before they go home, to check for intracranial bleeding and ischaemia. Other scans are added when clinically required. The germinal matrix, a vascular network in the caudothalamic groove, is very fragile to sudden changes in homeostasis, especially to the development of a pneumothorax. Minor haemorrhages in the germinal matrix or into the lateral ventricles (previously called grade 1 & 2) generally have no sequelae. Major haemorrhages (grade 4 into the parenchyma of the brain, or grade 3 causing ventricular dilatation) have longterm effects. Blood in the CSF causes inflammation which can obstruct the aqueduct or the arachnoid granulations, resulting in hydrocephalus. The germinal matrix degenerates by term, so term infants don't get these haemorrhages. Subarachnoid haemorrhage generally isn't visualised by ultrasound. If a baby has focal signs and a normal ultrasound, CT should be considered.

Hypoxia can cause cerebral oedema, which is difficult to detect by ultrasound. Some stressed fetuses or prem neonates develop periventricular ischaemia, in the watershed area between the superficial and deep circulations (cf. adults with stroke). Ischaemic areas appear echogenic on US (periventricular flare), but can return to normal. If infarction occurs, the affected area liquefies, resulting in cysts (periventricular leukoencephalopathy/leukomalacia/PVL). Bilateral parietal PVL leads to degrees of spastic quadriplegia. If the cysts break into the ventricular system, the appearance is called porencephaly. The debris may obstruct CSF circulation.

US is used to assess palpable abdominal masses, to assess the biliary tree if there is prolonged jaundice, and to follow up babies whose antenatal scans suggested renal, intracranial or other visceral anomalies. It plays a major role in confirmation of a patent ductus in prems, and in diagnosing structural cardiac abnormalities.

Ultrasound is preferable to Xray to manage dislocated hips under six months of age, as the femoral head is invisible to Xrays. In general hip scans should be postponed till 6 weeks of age, as the development of the acetabulum is still evolving in the neonate).

In small infants it can be used to scan the spine, if there is a sacral dimple etc; later, the spine is too well ossified to see through.

MRI can be used in neonates but there are problems with monitoring the baby and maintaining its temperature.