ISUOG Basic Training

Distinguishing between Normal & Abnormal Appearances of the Long Bones & Extremities

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Learning objectives 15 & 16

At the end of the lecture you will be able to:

• describe how to obtain the planes required to assess the four limbs correctly

• recognise the differences between the normal & most common abnormal ultrasound appearances of the legs, arms & extremities
<table>
<thead>
<tr>
<th>15</th>
<th>Limbs</th>
<th>Femur diaphysis length</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td></td>
<td>3 long bones of both legs, both feet &amp; normal relationships to both legs</td>
</tr>
<tr>
<td>17</td>
<td></td>
<td>3 long bones of both arms, both hands &amp; normal relationships to both arms</td>
</tr>
</tbody>
</table>
# Moving through the 20 planes

<table>
<thead>
<tr>
<th>Plane</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>transverse section of pelvis, bladder, both umbilical arteries</td>
</tr>
<tr>
<td>15</td>
<td>femur diaphysis length*</td>
</tr>
<tr>
<td>16</td>
<td>3 bones of both legs, both feet &amp; normal relationships to both legs</td>
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<tr>
<td>17</td>
<td>3 bones of both arms, both hands &amp; normal relationships to both arms</td>
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</tbody>
</table>

- from plane 14 to 15 – slide & rotate
- from plane 15 to 16 – slide, rotate (& angle)
- from plane 14 to 17 – slide to upper chest, rotate (& angle)

* measurement required
20 + 2 planes & abnormal appearances

<table>
<thead>
<tr>
<th>Plane</th>
<th>Area</th>
<th>Abnormal appearances (50+IUD) excluded by the correct 2+20 approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweep 1</td>
<td>Area</td>
<td>anencephaly, IUD</td>
</tr>
<tr>
<td>1-3</td>
<td>Spine</td>
<td>abnormal abdominal situs, left sided diaphragmatic hernia, meningocoele, open spina bifida, sacral agenesis, sacral coccygeal teratoma,</td>
</tr>
<tr>
<td>4-6</td>
<td>Head</td>
<td>alobar holoprosencephaly, banana shaped cerebellum, cystic hygroma, large posterior fossa cyst, lemon shaped skull, occipital encephalocele, skin oedema, ventriculomegaly</td>
</tr>
<tr>
<td>7-10</td>
<td>Thorax</td>
<td>AVSD, CPAM, double aortic arch, ectopia cordis, overriding aorta, persistent left vena cava*, right aortic arch, severe aortic stenosis, coarctation &amp; pulmonary stenosis, significant pericardial effusion (&gt;4.0mm) &amp; pleural effusion (&gt;4.0mm), situs inversus/ambiguous, tetralogy of Fallot, transposition, univentricular heart</td>
</tr>
<tr>
<td>11-13</td>
<td>Abdomen</td>
<td>ascites, bilateral renal agenesis, duodenal atresia, echogenic bowel*, gastoschisis, omphalocoele, renal pelvic dilatation (&gt;7.0mm AP), small/absent stomach</td>
</tr>
<tr>
<td>14</td>
<td>Pelvis</td>
<td>cystic renal dysplasia, lower urinary tract obstruction, 2 vessel cord</td>
</tr>
<tr>
<td>15-17</td>
<td>Limbs</td>
<td>fixed flexion deformities wrist, severe skeletal dysplasia (some), talipes</td>
</tr>
<tr>
<td>15-17</td>
<td>Limbs</td>
<td>FL outside normal range of size chart</td>
</tr>
</tbody>
</table>
Basic training
Key questions

• What are the key ultrasound features of plane 15 (femoral diaphysis length)?

• What are the key ultrasound features of plane 16 (the leg)?

• What are the key ultrasound features of plane 17 (the arm)?

• Which probe movements are required to image the 3 long bones of a limb & extremity correctly?

• Which abnormalities should be excluded after correct assessment of planes 15, 16 & 17?
What are the key ultrasound features of plane 15 (femur diaphysis length)?

- Focal zone at appropriate level.
- Image magnified.
- Whole femur diaphysis imaged.
- Ultrasound beam perpendicular to long axis of femur.
- Calipers placed at each end of ossified diaphysis.
- Longest visible diaphysis is measured.
- Spur artifacts on end of diaphysis not included in measurement.
What are the key ultrasound features of plane 16 (femur diaphysis length)?

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<thead>
<tr>
<th></th>
<th>BPD</th>
<th>AC</th>
<th>FL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Symmetrical plane</td>
<td>Symmetrical plane</td>
<td>Both ends of the bone clearly visible</td>
</tr>
<tr>
<td>2</td>
<td>Plane showing the thalami</td>
<td>Plane showing the stomach bubble</td>
<td>&lt;45° angle to the horizontal</td>
</tr>
<tr>
<td>3</td>
<td>Plane showing the cavum septi pellucidi</td>
<td>Plane showing the portal sinus</td>
<td>Femoral plane occupying more than half of the image size</td>
</tr>
<tr>
<td>4</td>
<td>Cerebellum not visible</td>
<td>Kidneys not visible</td>
<td>Calipers placed correctly</td>
</tr>
<tr>
<td>5</td>
<td>Head plane occupying more than half of the image size</td>
<td>Abdominal plane occupying more than half of the image size</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Calipers and dotted ellipse placed correctly</td>
<td>Calipers and dotted ellipse placed correctly</td>
<td>-</td>
</tr>
</tbody>
</table>

**TOTAL SCORE**
Basic training
Basic training
Basic training
It is better to have an orthogonal approach of femoral diaphysis

Orthogonal approach and measuring the antero-external side
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What are the key ultrasound features of plane 16 (the leg)?

- Number of bones
- Length
- Echogenicity
- Shape
- Position
- Movements
What are the key ultrasound features of plane 16 (the leg)?

- 90 degrees rotation
- Translation towards the foot
What are the key ultrasound features of plane 16 (the leg)?

• 90 degrees rotation
• Translation towards the foot
What are the key ultrasound features of plane 17 (the arm)?
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Guidelines

• The presence or absence of both arms/hands and both legs/feet should be documented using a systematic approach.

• Counting fingers or toes is not required as part of the routine mid-trimester scan
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Which abnormalities should be excluded after correct assessment of planes 15, 16 & 17?

- Number of bones
- Length
- Echogenicity
- Shape
- Position
- Movements
Which abnormalities should be excluded after correct assessment of planes 15, 16 & 17?

- Number of bones: agenesis…
- Length: short femur…
- Shape: curved, fracture…
- Position: Talipes,…
- Movements: fixed,…
- (Echogenicity: Osteogenesis Imperfecta…)

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Shape

- Short?
- Curved?
Shape

• Short?
• Curved?
• Fracture?
Position: Talipes
Talipes
Basic training
Number: Radial agenesis
Number
Position-Movements
Movements
Polydactyly
Polydactyly

- Normal

Dr BAULT JP
Key points

1. Planes 15, 16 and 17 allows identification of the most common pathologies of the limbs
2. Always check number of bones, shape, position and movements
3. Your role is to distinguish between the range of normal & abnormal appearances
4. Any appearance which you cannot confirm as normal should be referred for a more experienced opinion.