Bovine Reproductive Ultrasound Training

Extension Arm Ultrasound Training and Fetal Aging

By Andrew Bronson DVM
ReproScan
Value Added Pregnancy Testing

One Example:

Heifer Calving Date Positively Influences Calf Weaning Weights through Six Parturitions
R. Cushman*, L. Kill, R. Funston, E. Mousel, G. Perry

Longevity and lifetime productivity are important factors influencing profitability for the cow-calf producer. Heifers that conceive earlier in the breeding season will calve earlier in the calving season and have a longer interval to rebreeding. Calves born earlier in the calving season will also be older and heavier at weaning. Longevity data were collected on 2,195 heifers from producers in South Dakota Integrated Resource Management groups. Longevity and weaning weight data were collected on 16,549 individual heifers at the U.S. Meat Animal Research Center (USMARC). Data were limited to heifers that conceived during their first breeding season. Heifers were grouped into 21-d calving periods. Heifers were determined to have left the herd when they were diagnosed not pregnant at the end of the breeding season. Heifers that left the herd for reasons other than reproductive failure were censored from the data. Heifers that calved with their first calf during the first 21-d period of the calving season had increased (P < 0.01) longevity compared with heifers that calved in the second 21-d period, or later. Average longevity for South Dakota heifers that calved in the first or later period was 5.1 ± 0.1 and 3.9 ± 0.1 yr, respectively. Average longevity for USMARC heifers that calved in the first, second, or third period was 8.2 ± 0.3, 7.6 ± 0.5, and 7.2 ± 0.1 yr, respectively. Calving period as a heifer influenced (P < 0.01) unadjusted weaning BW of the first 6 calves. Estimated postpartum interval to conception as a 2-yr-old cow was greater for females that calved in the first period as heifers but did not differ between heifer calving periods in subsequent calving seasons. In summary, heifers that calved early in the calving season with their first calf had increased longevity and kilograms weaned, compared with heifers that calved later in the calving season.

Submitted by the AABP Beef Health Management Committee.
This is our first day. Do you have any idea which one of these things is the rectal probe?
Bovine Reproductive Ultrasound Training

1. Why do we ultrasound cattle?
2. How do we ultrasound cattle?  
   - the basics of cattle ultrasound
3. Pregnancy Diagnosis and Fetal Aging
4. Diagnosing open cows with ultrasound
5. Use of Extension Arms
6. Other information
1. Why do we ultrasound cattle?

1. Improved accuracy of diagnosis.  
   *It is much easier and more accurate to see things than to feel.*

2. It is easier to learn to ultrasound than to palpate.  
   *Someone can learn to ultrasound in a few days and to be a palpater takes much longer.*

3. Ultrasound provides better economic value because there are less mistakes made.  
   *Mistakes cost dairy and beef producers a lot of money.*

4. When cattle producers learn about the advantages of ultrasound, *they will insist on ultrasound services.*

5. *Extension Arm Ultrasound can save your body and time.*
### Advantages of Reproductive Ultrasound versus Palpation

<table>
<thead>
<tr>
<th></th>
<th>Palpation</th>
<th>Ultrasound</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Pregnancy Test</td>
<td>35 to 40 days</td>
<td>25 to 27 days</td>
</tr>
<tr>
<td>Fetal viability (heart beat)</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Fetal Sex</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Twins (timing of check is important)</td>
<td>65% accurate</td>
<td>95% accurate</td>
</tr>
<tr>
<td>Embryo Transfer</td>
<td>Less accurate</td>
<td>Yes – count Corpus Luteum</td>
</tr>
<tr>
<td>Ovarian Structures (CL, follicles, inactive)</td>
<td>60% accurate</td>
<td>95% accurate</td>
</tr>
<tr>
<td>Metritis (infection)</td>
<td>Variable</td>
<td>Usually</td>
</tr>
<tr>
<td>Vaginitis</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Cattle Ultrasound is Safe

1. Ultrasound is a painless procedure.

2. Ultrasound does not use radiation, therefore the side effects of radiation are not an issue.

3. *Ultrasound equipment emits sound waves!*

4. Ultrasound is the preferred technique for cattle pregnancy.

5. There are no known harmful effects of standard ultrasound imaging.

6. Ultrasound is a non-invasive imaging technique.

The basic principles are the same whether or not you put your arm in the cow or use an extension arm.
The Basics of Ultrasound

1. The transducer (rectal probe) emits sound and detects the returning echoes when it is placed on or over the body part being studied.

2. The processor (ReproScan module) makes a “picture” out of the returning sound waves.
Fetus in the placenta

Image on the screen or goggles

Image courtesy of the Drost Project
http://www.drostproject.org/
There are many different types of probes (not to scale)

**Linear Rectal Probes – 6.5 MHz**
Primarily used for “arm in cow” reproductive cattle and horse ultrasound.

**Convex Rectal Probes**
Used for “arm in cow” reproductive cattle and horse ultrasound and “extension arm” cattle ultrasound.

**Mechanical Sector Probes**
- Moving parts are prone to breakage
  - 3.5 MHz for pigs, sheep, goats
  - 3.5 MHz cattle probe
  - 3.5 MHz sheep probe

**T Handle Probes**
Used for human and small animal ultrasound scanning

**Carcass Probes**
Used for IMF and REA scanning
(intramuscular fat and rib-eye area)

17 cm long
Compare the area scanned by different types of probes:

- **4.0 MHz convex rectal probe**
- **6.5 MHz linear rectal probe**

The area scanned by a 6.5 MHz probe is slightly larger than a credit card.

3 to 5 times larger area is scanned - varies with the depth setting.
Compare the area scanned by different types of probes:

4.0 MHz convex rectal probe

6.5 MHz linear rectal probe

If a linear probe is used to scan advanced pregnancies, it is much more difficult to find and age the fetus. This is an example of the advantages of the 4.0 MHz probe for aging pregnancies.
Repro-Scan has a unique **4.0 MHz Convex Rectal Probe** that “fans” out the sound waves to cover a larger area.

Note: The 11 cm depth setting is a commonly used setting with this probe.
Linear Probe: $5.5 \times 7.5 \text{ cm} = 41 \text{ cm}^2$

Convex Probe 11 cm depth = 112 cm$^2$

Convex Probe 22 cm depth = 315 cm$^2$
SOUND WAVES GO THROUGH FLUID, THEREFORE FLUID IS BLACK

SOUND WAVES BOUNCE OFF BONE, THEREFORE BONE IS WHITE
Understanding Probe Orientation

Repro-Scan ultrasound units are set with a “LEFT” probe orientation.

If you touch the tip of the probe here, the image of your finger shows up here on the left of the screen.
Understanding Probe Orientation

1. As a left oriented probe advances ....

2. ....new information appears on the left side of the monitor.
Understanding Probe Orientation

Moving the probe ahead will move the scanned area past the fetus in this example.
Factors affecting ultrasound image quality

Ultrasound waves –
are unable to penetrate bone or gas

– Dry manure has air and larger particles in it and poor images may result
Factors affecting ultrasound image quality

Ultrasound waves pass easily through fluids and soft tissues.

Therefore, wet loose manure gives good images.

1. Very good.
2. Very good.
3. This manure will reduce image quality.
4. Very dry manure. Supplement feed before attempting to ultrasound.
How do we get an image?

Red and Blue Lines represent sound waves.

Probe in Rectum

Some sound waves bounce off the uterus

Some sound waves bounce off the fetus
How do we get a *good clear* image?

1. Fluid in Rectum (wet manure)
2. Probe must contact the floor of the rectum
3. Proper positioning of the probe over the target (fetus)
We now know how the image gets on the screen. (or the image may be viewed in a set of goggles)
3. Pregnancy Diagnosis and Fetal Aging
As the pregnancy develops, fluid, membranes and fetus develop in the uterus.
There are 4 main signs of pregnancy.
Fluid in Uterus
3. Cotyledons or Placentomes
Amnion or Birth Sac
From Biology of Reproduction

Scanning like this

Would appear like this
3 Signs of Pregnancy are seen
1. Fetus
2. Fluid in the uterus
3. Cotyledons
Scanning like this

Would appear more like this

From Biology of Reproduction
2 Signs of Pregnancy are seen
1. Fluid in the uterus
2. Cotyledons (Buttons)
Pregnant Uterus - 30 Days.
The larger pregnant horn is on the same side as the corpus luteum.
Chenoweth PJ (2012)

Ovary with CL (corpus luteum)

32-Day Pregnancy.
This scan shows a cross section of the gravid horn.

5 centimeter squares
This is a 40-day pregnancy. Note the thin amniotic membrane surrounding the embryo. Allantoic fluid surrounds the amniotic vesicle.

Pregnant Uterus - 40 Days.
The larger pregnant horn is on the same side as the corpus luteum.
Chenoweth PJ (2012)
5 centimeter squares
Day 40 Pregnancy.
The embryo proper is surrounded by the amniotic vesicle which in turn is enclosed in the allantois. [5 cm squares]
Chenoweth PJ (2012)

This is a 40-day pregnancy.
Note the thin amniotic membrane surrounding the embryo. Allantoic fluid surrounds the amniotic vesicle.
4.0 MHz convex rectal probe image.

Bronson AR 2012
Pregnant Uterus - 50 Days.
Chenoweth PJ (2012)
[5 centimeter squares]

50-Day Pregnancy.
This is a 50-day pregnancy.
CRL approx. 4 cm.
Bronson AR (2012)
Day 55 Bovine Conceptus.
The chorio-allantois has been removed over the amniotic vesicle (6.5 cm) to expose the little fetus.
Drost M (1982)
Pregnant Uterus - 60 Days.
A small fetus, the size of a mouse, can be palpated in the gravid horn. [5 centimeter squares]
Chenoweth PJ (2012)

62-Day Pregnancy.
This is a 62-day pregnancy. Note the fetal shape is complete. Skull is now echogenic and can be measured.
Bronson AR (2012)
Day 95 Conceptus.
The fetal head measures 6.5 cm from the tip of the nose to the forehead.

[5 cm square]
Chenoweth PJ (2012)
Day 120 Pregnancy
The fetus is the size of a small cat at 4 months of gestation.
Chenoweth PJ (2012) [5 cm squares]

Day 120 Pregnancy (this one is upside down)
A scan through the thorax of a 120 day fetus may look like this when a 4.0 MHz convex rectal probe is used.
Day 120 Pregnancy
The head is 10cm long and fills most of the field of view when a 4.0 MHz convex rectal probe is used with a 11 cm depth setting.

Day 120 Pregnancy
The fetus is the size of a small cat at 4 months of gestation.  Chenoweth 2012
The fetus is the size of a small cat at 4 months of gestation.  Chenoweth 2012
Day 120 Pregnancy – backwards position
22 cm depth setting, 4.0 MHz convex probe
More of the fetus is visible.

Day 120 Pregnancy – rotated to appear backwards
The fetus is the size of a small cat at 4 months of gestation. Chenoweth 2012
Day 120 Pregnancy – only placentomes are seen in this scan. Fetus may be out of reach. 22 cm depth setting, 4.0 MHz convex probe.
Day 135 Pregnancy
The fetus is the size of a cat at 4.5 months of gestation. The cotyledons are largest near the optimal blood supply and nearest the umbilical cord attachment. [5 cm squares] Chenoweth PJ (2012)

135-Day Pregnancy.
The fetus is too deep to see in this scan.

4.0 MHz convex rectal probe
Bronson AR (2012)
Aging Pregnancies

• In theory, bovine pregnancies are aged by measuring fetal structures as seen on “frozen” ultrasound images

• In practice, time and skill constraints may make freezing images impractical. This is especially true with extension arm ultrasound.

• Grids over the image aid with quick fetal measurements

• Estimated size and stage of fetal development make estimating age of a fetus reasonably accurate

• With experience aging within 10% is considered good
  Eg. 100 day pregnancy is called between 90 and 110 days, 40 day pregnancy is called between 36 and 44 days

• Further experience can narrow the margin of error further eg. 5%
Fetal Aging Charts are available.

Most veterinarians use head diameter for the most accurate, repeatable measurement.

<table>
<thead>
<tr>
<th>Days</th>
<th>Crown / Rump Length</th>
<th>Head Length (nose to crown)</th>
<th>Trunk Diameter</th>
<th>Placentome Diameter (Cotyledons - note large variation)</th>
<th>Eye Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>1</td>
<td>0.8 - 1.2</td>
<td></td>
<td></td>
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<tr>
<td>35</td>
<td>1.4</td>
<td>1.3 - 1.7</td>
<td></td>
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<tr>
<td>40</td>
<td>2</td>
<td>1.7 - 2.4</td>
<td></td>
<td></td>
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<tr>
<td>45</td>
<td>2.5</td>
<td>2.3 - 2.8</td>
<td></td>
<td></td>
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<tr>
<td>50</td>
<td>4</td>
<td>3.8 - 5.8</td>
<td>0.7</td>
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<tr>
<td>55</td>
<td>5.5</td>
<td>1.2</td>
<td>1.5</td>
<td></td>
<td></td>
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<tr>
<td>60</td>
<td>7</td>
<td>1.6</td>
<td>1.7</td>
<td>0.3 to 0.5</td>
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<td>65</td>
<td>8</td>
<td>1.9</td>
<td>2</td>
<td></td>
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<td>70</td>
<td>10</td>
<td>2.1</td>
<td>3</td>
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<td>0.6</td>
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<td>80</td>
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<td>2.6</td>
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<td>0.8</td>
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<td>3.2</td>
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<td>1.0 to 1.5</td>
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<td>16</td>
<td>3.8 - 4.0</td>
<td>6</td>
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<td>1.2</td>
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<td>110</td>
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<td>5</td>
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<td>1.5 to 2.5</td>
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<td>120</td>
<td>25</td>
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<td>1.6</td>
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<td>7</td>
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<td>33</td>
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<td></td>
<td></td>
<td>1.9</td>
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<td>150</td>
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<td>8.9 - 9.6</td>
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<td>2.5 to 4.0</td>
<td>2</td>
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<td>160</td>
<td>40</td>
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</tr>
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<td>180</td>
<td>4</td>
<td>4 to 5</td>
<td>2.4</td>
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<td></td>
</tr>
<tr>
<td>210</td>
<td>5</td>
<td>5 to 7</td>
<td>2.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>240</td>
<td>6</td>
<td>6 to 9</td>
<td>2.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>270</td>
<td>8</td>
<td>8 to 12</td>
<td>2.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

References and Acknowledgements:
Youngquist, R.S. and Throntveit, W.R., Rumination and Camelid Reproductive Ultrasoundography, 2010

ReproScan
Veterinary Ultrasound Technology
The Most Commonly Used Fetal Measurements

- **Head Diameter**
- **Crown Rump Length (CRL)**
- **Head Length (nose to crown)**
Other Fetal Measurements that are used for Aging

- Trunk Diameter
- Eye Diameter
- Placentome Size?
Using the grid: 2+ cm HD, 2.5 cm TD, 10 cm CRL
Approximate age: 70 to 75 days, round up to 75
A 10 to 15 day calving distribution is common after a fixed time AI program. There may to “outliers” as in the above project that resulted in a 28 day calving distribution.
• 16 to 21 day calving distribution results from 5 timed AI programs

• Sire B and Sire E are the same sire in 2 different locations
To quickly and reasonably accurately age fetuses the following criteria are often used:

1. stage of fetal development (30 to 65 days)  
   (size of fetus (estimated), developmental characteristics)
2. size of head, thorax, hind quarters (65 to 120 days)  
   (head diameter, trunk diameter)
3. relative size of fetus and uterine development
4. size of placentomes – not very accurate due to variability of size
5. For advanced pregnancies (120+) consider a 22 cm depth setting and use head measurements?
This slide shows relative development and size of fetuses as pregnancies advance.

- **35 Days**
  - 1.4 cm diameter

- **39 Days**

- **45 Days**

- **85 Days**
  - 13 cm body length

- **100 Days**
  - 6 cm head length

- **115 Days**

- **Advanced Pregnancy**
  - Over 4 Months
Another series of images showing relative stage of fetal development.

Fetal aging can be done by memorizing the stages of fetal development.

This is the fastest method and accuracy improves with practice.

Perfect this technique in herds with good artificial breeding records.

It is recommended to use the same settings and the same type of equipment for doing aging this way.
Fluid detected - an early pregnancy

Appears like this
There is fluid in the side of the uterus that the pregnancy is in.

25 to 30 day pregnancies may appear like this.
The white oval is the embryo.

Not easily detected below 30 days.
Multiple fluid filled circles – fluid of pregnancy, the embryo may not be readily visible.
The fetus does not have to be seen to make a diagnosis of pregnancy.

38 Day Pregnancy – Fetus visible

Same 38 Day Pregnancy – Fetus not visible
39 days
39 days

Multiple fluid filled horns
Bug with antennae?

Think of names to help remember stage of development.
You can make out the legs on this fetus
65 day fetus viewed with 4.0 MHz convex rectal probe. Most body structures are visible at 65 days. Rib cage is clearly visible.
70 days
85 days
100 days
16 cm length
= longer than field of view with this setting

This is a cross-sectional view of the fetus
100 days
You can see structures inside the developing fetus
120 Days

10 cm Head Length

The head almost fills the screen
These are what placentomes (cotyledons) look like at 120 days in this beef heifer.
They are dense white oval structures
Use caution when “aging” the pregnancy at this stage as the size and shape of the placentomes may change as you rotate and move the probe.
Note the developing cotyledons (placentomes) of the pregnancy - they are different sizes from an early age in some cows.

www.liv.ac.uk/vets/current/dbr.htm
Note: there is a large variation in these placentomes.
These placentomes appear more uniform in size in this 135 day large framed beef heifer.
Clear Fluid in Allantois = First Sack

Birth sack – Amnion has debris from fetus. This is normal in pregnancies over 90 days.
Fluid can be cloudy in advanced pregnancy.
Be cautious when trying to stage pregnancy based on cotyledon (button) size.
Trimester Fetal Aging System
This is being used in some areas of USA.

<table>
<thead>
<tr>
<th>Placentome (Cotyledon) Diameter</th>
<th>Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3 to 0.5</td>
<td>60</td>
</tr>
<tr>
<td>0.5 to 0.75</td>
<td>70</td>
</tr>
<tr>
<td>0.5 to 1.0</td>
<td>80</td>
</tr>
<tr>
<td>1.0 to 1.5</td>
<td>90</td>
</tr>
<tr>
<td>1.0 to 2.0</td>
<td>100</td>
</tr>
<tr>
<td>1.5 to 2.5</td>
<td>110</td>
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<tr>
<td>2.5 to 4.0</td>
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<td>4 to 5</td>
<td>150</td>
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<td>5 to 7</td>
<td>180</td>
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<tr>
<td>6 to 9</td>
<td>210</td>
</tr>
<tr>
<td>8 to 12</td>
<td>240</td>
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</table>

Note: Large Variation in Placentome Size

<table>
<thead>
<tr>
<th>Missouri Trimester System</th>
<th>Criteria</th>
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<tbody>
<tr>
<td>1st</td>
<td>size of fetus</td>
</tr>
<tr>
<td></td>
<td>head diameter &lt; 3 cm</td>
</tr>
<tr>
<td></td>
<td>Placentomes &lt; 2 cm</td>
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<tr>
<td>2nd</td>
<td>size of fetus</td>
</tr>
<tr>
<td></td>
<td>head diameter &gt; 3 cm</td>
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<tr>
<td></td>
<td>head diameter &lt; 12</td>
</tr>
<tr>
<td></td>
<td>Placentomes &gt; 2 cm</td>
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<tr>
<td></td>
<td>Placentome &lt; 4 cm</td>
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<tr>
<td>3rd</td>
<td>size of fetal structures (feet)</td>
</tr>
<tr>
<td></td>
<td>head diameter &gt; 12 cm</td>
</tr>
<tr>
<td></td>
<td>Placentomes &gt; 5 cm</td>
</tr>
</tbody>
</table>

- being developed by Dr. John Bolinger, Tipton, MO

Dr. Brad Stroud is from Texas, smaller cattle in a warmer climate = smaller placentomes?

Add at least 1 cm to these measurements for Western USA & Canada
6 cm Placentome = 3rd Trimester? Be careful!
4. Using Ultrasound to find “Open” cows
The bladder containing urine is positioned here.
Bladder containing urine is positioned here.

Modified From Select Sires Website
Remember the coffee cup!

Fluid filled Bladder
3 Cervical Rings
-often above the bladder

Pelvis
The **Bladder** is an important landmark.
Pelvis

Ovary

Right Horn of Uterus

Cervix

Left Horn of Uterus

Ovary

Modified From Select Sires Website
Pelvis

Cervix

Uterus

Ovary

Modified From Select Sires Website
Ultrasound may “slice” through 3 sections of the uterus.

May appear like this
The ultrasound image of the uterus will depend on the position of the probe and the position of the uterus.

Multiple cross sections of uterus may be seen.
CrossSections = “Slices” of the Empty Uterus
How we get this image?

Side view of a cow. Note the spine and tail for landmarks.
How we get this image?

Think of the Probe as a knife that makes a paper thin slice and we see the slice!
How we get this image?

Note the 2 horns of the uterus
How we get this image?

Again, note the 2 horns
How we get this image?

Here is the uterus viewed from above the cow, just like looking down at the cow from the top.
How we get this image?

The sound waves come out and take cross-sectional views of the horns.
How we get this image?

Visualize cutting a pipe.
How we get this image?

The image we see

Looking into the end of the pipe
How we get this image?

The image we see

Looking into the end of the pipe

One cross section of the open uterus outlined in yellow dots.
But, the uterus of a cow is not fixed into position like a mare.

That is why we get multiple cross sections of the empty uterus in one field of view.

Think of scanning snakes! Not rigid pipes.
Why do we see multiple views of the uterine horn in cross-section?

When we scan we may get multiple cross-sections.
A “slice” through the uterus may appear like this.
We often get other “slices” of the uterus and bladder.

1. **Longitudinal Section “Slice” of the empty uterus**
   = sausage

2. **Cross section of empty the uterus**
   = donut

3. **Pelvis bone**

4. **Bladder**
   = clear fluid (Black)
Open Uterus
Open Uterus
Open Uterus
5. Extension Arm Technique for Scanning Cows

Using the Repro-Arm
with 4.0 MHz Convex Rectal Probe
Hold the Repro-Arm with 2 hands when ever possible.

This will protect the crystals in the probe face from trauma due to dropping.
Watch out for the cow’s tail.
Use an approved lubricant such as J-Lube mixed with water or methylcellulose obstetrical lubricant when necessary.

This is especially important with cattle with dry manure such as heifers and beef cows seasonally.

Lubricant helps in 3 ways.

1. It helps keep the face of the probe clean.
2. It allows better contact with the floor of the rectum.
3. It helps the slide through the anus and into the rectum easier.
How to do a careful ultrasound examination of the uterus of a cow with an extension arm?
How to scan a cow with an extension arm:

1. Enter rectum with a quick 1 cm push.

2. Go to the estimated site of a 1st cycle pregnancy.

3. Find the diagnostic signs of pregnancy.
   *Fetus for aging or at least 3 signs of pregnancy for pregnant yes/no only.*

4. Scan uterus from ovary to ovary to diagnose open.

5. Go deeper into abdomen if nothing is found initially.

6. Check the pelvis above the rectum for the uterus. It is often there in pregnancies less than 70 days.

**ReproArm technique is very important!**

*Think of extension arm ultrasound as an athletic skill that requires practice.*
1. Enter Rectum

2. Go to estimated position of 1st cycle pregnancy

3. If no pregnancy found, scan ovary to ovary over the uterus
How to scan a cow with an extension arm. (not to scale)

Complete a 180 degree sweep

Repeat before calling open.

Use 40 days as initial extension arm “sensitivity” for open. Check yourself by palpating initially.
How to scan a cow with an extension arm. (not to scale)

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Complete a 180 degree sweep

Repeat before calling open.

Use 40 days as initial extension arm “sensitivity” for open. Check yourself by palpating initially.
Watch the next 2 videos to get an idea of technique for entering the rectum.
Line up the anus
– it’s just above the Vulva
Insert into anus with a smooth motion.

A 1 cm firm push may be required.
ReproArm technique continued...

3. 50 to 70% of pregnancies are often conceived in the 1st cycle.
Therefore, quickly move to the location where most of the 1st cycle pregnancies will be found.
Quickly insert the probe to the estimated location of uterus.
- just past the bladder in early pregnancies (35 to 90 days)
- deeper in advanced pregnancies
- Twist Repro-Arm to maintain contact with the rectum
ReproArm technique continued...

4. The amount of downward pressure on the rectum is very important.

Too little pressure gives a poor image.

Too much downward pressure flattens the uterus. This makes diagnosis of empty or early pregnancy more difficult.
ReproArm technique continued...

In the next video clip, the correct amount of downward pressure is applied to the probe end of the ReproArm. Note the multiple cross sections of empty uterus. The uterus is not “squished down”.

Note ovary at the end of the clip.
You may need to reduce downward pressure of the probe on the rectum to get multiple cross sections in one field of view...
5. Advanced pregnancies are another challenge. This is especially true in large deep bodied cows.
The pregnant uterus is down deep in the abdomen in this diagram.

Diagram courtesy of Prof. Pat McCarthy, Australia
The fetus is not seen in this 150+ day pregnancy. Placentomes are positive proof of pregnancy.

The fetus may be too deep to reach with Repro-Arm.
Advanced Pregnancies are often in the lower right quadrant of the abdomen. The rumen often pushes pregnancies greater than 100 days over to the right side of the abdomen. A fetus deep in uterus and lying on the floor of the abdomen.
ReproArm technique continued...

6. In some cows, the uterus drops quickly over the brim of the pelvis. This is often the case in Holsteins and older cows. Look over the brim of the pelvis. You must get down between the pelvic brim and the rumen.
The pregnant uterus may drop quickly over the brim of the pelvis in some cows, especially in advanced pregnancies, old cows and Holsteins.
6. Safety Concerns

Dealing with Rectal Contractions = Straining

• A cow will have a rectal contraction or “strain” soon after the probe is inserted.

• Cows on some loose diets such as grass silage may strain more

• Allow the contraction to pass before inserting the Repro-Arm further into the rectum

• Alternatively, the operator may tip the transducer end (probe end) of the Repro-Arm up and “thread” through the contraction very carefully
Dealing with rectal contractions:

Repro-Arm in Rectum of Cow

Contraction of Rectum stops the Repro-Arm
Dealing with rectal contractions:

1. Stop all forward pressure immediately.

2. Wait for most of the Contraction to pass.
Dealing with rectal contractions:

3. Lower Repro-Arm handle (this raises tip)

4. Twist Repro-Arm to “thread” through contraction carefully.
Dealing with rectal contractions:

Contraction of Rectum stops the Repro-Arm

Never lift handle and press hard. A rectal perforation may occur. The animal may die of peritonitis. (infection)
--- Warning --- *rectal perforations are a concern*

- The use of Repro-Arm with the Repro-Scan ultrasound unit can result in rectal perforations if proper technique is not followed.
- Veterinarians have successfully pregnancy tested hundreds of thousands of beef and dairy cows with the Repro-Arm without complications.
- Yet, occasionally, a rectal perforation occurs.
- Rectal perforations may result in localized peritonitis or a serious case of peritonitis resulting in the death of the cow.
- It is the responsibility of the operator of the Repro-Arm to follow safe techniques so that rectal perforations do not occur.
- *Repro-Scan, LLC, Repro-Scan Australia Pty. Ltd. and BioCheck take absolutely no responsibility for rectal perforations. They are only due to operator error.*
7. **Backup Plan for cows when:**

**Open or Pregnant cannot be determined**

The ultrasonographer needs to have a backup plan. (This is especially true at the time of early pregnancy diagnosis.)

**Options include:**

1. Manually move the uterus and/or cervix (arm in rectum), then re-examine with the Repro-Arm.
2. Palpate the cow. (many palpators cannot palpate under 40 quickly and accurately – therefore limitations to this plan)
3. Take the probe out of the Repro-Arm and examine uterus with probe in hand. (if time permits or do later)
4. Leave cow until pregnancy is more advanced.
5. Come back another time (eg. End of herd check – uterus may have moved to a better position)
Backup Plan #1
Manually manipulate the uterus for a better scan
Step 1

Reach into rectum, hold the cervix and retract the uterus.
Backup Plan #1

Step 2

Then, re-insert the Repro-Arm and scan over the uterus
Backup Plan #3

Scanning with probe in hand is a good skill to learn.
The person scanning has more control over the probe.
Carefully scan the uterus by hand if you did not see cross-sections of the open uterus when using the ReproArm.
8. Setting up your ultrasound at the chute.

Some things to consider:

• The way the ultrasound is set up is important
• Safety of people, cattle and equipment
• Think of cattle flow and where you want to be positioned.
• Sunlight is a big factor and must be dealt with
• No ultrasound equipment is 100% waterproof
• Sheds are idea but equipment must work where you work
ReproScan unit suspended by a bungee cord.
9. Interesting Cattle Ultrasound Images

These images show some of the benefits of ultrasound compared to palpation.
CLs on each ovary.
A CL on each ovary suggests the possibility of twins in contralateral uterine horns.

Colloton J (2006)

Pregnant Uterus - 60 Days Twins.
There are 2 corpora lutea (CLs), one on each ovary.   Chenoweth PJ (2012)
Dead Fetus

The extreme flocculence in the pregnancy fluid indicates that this fetus died some time ago. A dead fetus can remain in the uterus for days to weeks before being expelled. Note that the fetus and amniotic membrane are still easy to identify. This pregnancy would feel normal on palpation.

Colloton J (2006)
Dead fetuses (Dead twins)

Note the flocculence in the amniotic fluid and the lack of form in the 54-day fetuses. Limbs, heads, abdominal organs, hearts and ribs could readily be seen. This pregnancy felt normal on palpation.

Colloton J (2006)
Luteinizing Cyst.

This fluid-filled structure has a thick luteal wall, but may be misdiagnosed as a follicular cyst on palpation. This may be a variation of a normal fluid-filled corpus luteum or it may be a luteinizing follicular cyst. The fine lines are trabeculae representing reflections.

Colloton J (2006)
T. Foetus Abortion.
Remnants of a 2-month old fetus in the uterus of a cow that tested positive for Tritrichomoniasis.

Bolinger JD (2011)
Causes of Abnormal Images and Unusual Ultrasound Findings

- Metritis – especially prevalent in dairy
- Dead Fetus - spontaneous?
  - consider pathogens – Trich
  - look carefully for heart beat
- Mucometra - older cows in heat?
- Bladder - probe splits bladder in two shapes
  - old cows with bladder lesions
- Artifacts - fat, lymph nodes
Abnormal Uterine Fluid.

- Cross sections of each uterine horn, both with purulent material.
- Purulent material can appear as any shade of light gray to nearly white, depending on its density.
- Abnormal uterine fluid is easily differentiated from the normal fluid of pregnancy.
- Colloton J (2006) - probably on Aloka 500 5.0 MHz
- From the Drost Project www.drostproject.org
Metritis

- This is a cross section of one of the uterine horns. There is pus in the lumen and the uterine wall is thickened.
- Colloton J (2006)
- From the Drost Project www.drostproject.org
Fetal Demise due to Trichomoniasis

- This pregnancy was “normal” 38 days previously
- Trichomoniasis positive herd, 3 other dead fetuses detected on previous herd check
- Bolinger, Tipton, MO(2011) Repro-Scan 5200 4.0 convex rectal probe, 1.5X Zoom
Fetal Demise due to Trichomoniasis #2

- This pregnancy was “normal” 38 days previously
- Trichomoniasis positive herd, 3 other dead fetuses detected on previous herd check
- Bolinger, Tipton, MO(2011) Repro-Scan 5200 4.0 convex rectal probe, 1.5X Zoom
Pyometra – undetermined origin

- Amount of “debris” varies throughout uterus
Pyometra – undetermined origin

- Amount of “debris” varies throughout uterus
Bladder in a very old cow with polyps

- This cow was not pregnant. It was almost misdiagnosed as pregnant due to polyps on the wall of the bladder.
- Very thick walled bladder on palpation
- Bronson, 2010 Repro-Scan 5200 4.0 convex rectal probe, 1.5X Zoom
Twins
Diagnosing twins can be a challenge

• Great service to producers
  – especially with heifers
• Very difficult to provide this service reliably and economically in beef herds easier to find in dairy herds with multiple scans per gestation
• Stage of examination is critically important
• Best window to find twins – 40 to 75 days? (over the brim of the pelvis after that)
• Look for twin lines and extra uterine size/fluid
39-Day Twin Pregnancy.

- These 39-day old twin embryos are in opposite uterine horns and have a crown / rump length (CRL) of 21 mm.
- Colloton J (2006)
- From the Drost Project www.drostproject.org
100 Day Twins – not always detected, top one only
7. Biosecurity and the Care and Cleaning of Bovine Ultrasound Equipment
Biosecurity Topics

1. Biosecurity is a never ending challenge in our cattle world. It can be a very dirty world and pathogens may be present.

2. Ultrasound transducers (probes) and cords are sensitive to harsh disinfectants such as iodine and ammonia products.

3. Therefore, clean equipment thoroughly with soap such as liquid laundry detergent after each set of cows.

4. This may be inadequate in some situations such as Trichomoniasis infected herds, Leukosis control herds and Sale Barns. Check the owners manual for instruction for disinfecting the equipment in specific circumstances.
Biosecurity Topics continued...

5. Consider using a plastic probe cover. Below are different types of commercially available probe covers. Probe covers are used extensively in the human ultrasound world. At ReproScan, we are experimenting with various probe covers. We hope to have some recommendation soon.

6. In Leukosis control herds, consider washing the probe and cord with dilute disinfectant and/or soap between cows (squirt bottle). Do not take fecal material or blood between cows.
ReproScan Cattle Ultrasound Training

www.repro-scan.com

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