Bovine reproduction
Clinical ultrasound booklet
with Easi-Scan

Your animal imaging partner
This Bovine Reproduction Clinical Booklet has been designed by BCF Technology Ltd as a reference booklet for the reproductive tract in the cow and provides images to show different stages of the fertility and reproductive processes.

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Images generously provided by M.V. Juan Jose Ferzola, veterinarian doctor from AllVet Veterinarian Technology, Buenos Aires, Argentina. As a bovine reproduction specialist in Chivilcoy, province of Buenos Aires, Argentina, Juan Jose has been using ultrasound for the majority of his reproductive examinations since 1991. Additional images courtesy of Lucy Tyler MA VetMB CertCHP MRCVS of Hale Veterinary Group, Wiltshire, UK.

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Evaluation of the bovine reproductive tract is an essential aspect of both beef and dairy herd management.

In addition to manual palpation, ultrasonography is commonly used to examine and evaluate the cow’s reproductive tract. Transrectal ultrasonography is performed through the introduction of an ultrasound transducer (probe) into the rectum. This enables the architecture of the ovaries, uterus, reproductive vasculature and surrounding structures to be visualised and evaluated.

Linear-array transducers with frequency ranges of 5.0 to 7.5 MHz producing rectangular-shaped images are most commonly used. Linear transducers produce higher quality images of tissues directly beneath the surface of the probe (the ‘near’ field) compared to the wedge-shaped images produced by a sector transducer. However, sector probes may also be used.

At the start of each ultrasound examination, the animal should be adequately restrained. Excess faecal material may be removed from the rectum to facilitate examination of the reproductive tract. The lubricated transducer is then cupped in the operator’s hand and carefully inserted into the rectum. The transducer is placed firmly against the ventral aspect of the rectum (rectal floor) and the exam is started. All of the internal reproductive structures should be identified and evaluated in a systematic manner, including the ovaries, uterine horns, uterine body, cervix and vagina. The transducer, still within the operator’s cupped hand, is then gently withdrawn from the rectum.

The speed of ultrasound examination may approach that of manual palpation, depending on effective animal restraint and operator ability. However, it is also important to remember that the amount of useful information gained is increased through the use of ultrasonography, including early identification of non-pregnant cows, identification of cows carrying twins, assessment of foetal viability, determination of foetal sex, identification of ovarian structures and detection of ovarian/uterine abnormalities.

It is important to recognise both normal and abnormal structures on transrectal ultrasound examination. It is also essential to realise that there may be significant variation between cows. Therefore, ultrasound examination findings should always be interpreted in combination with farm records, herd data and visual observations (e.g. ‘heat’ detection).
Ovary

Anoestrus

The stroma of the anoestrus ovary has homogeneous echogenicity on ultrasound examination. Gross structures associated with cyclic activity such as follicles and corpora lutea are typically not visible. Small, truly anoestrus ovaries are usually only found in young heifers.

Active ovary

The components of the active ovary, including follicles, corpora lutea and ovarian stroma, have various echogenicities and therefore will appear as varying shades of grey on ultrasound examination.

Follicles
Follicles typically appear as anechoic regions within the ovarian stroma. However, it is not usually possible to distinguish the follicular wall from the surrounding stroma (apart from large pre-ovulatory follicles). Follicles do not always appear round due to transferred pressure from the transducer on the surrounding ovarian tissue.

Corpora lutea
Corpora lutea may be seen on the ovaries of most cows as true anoestrus is rare and the corpus luteum (CL) is present for two thirds of the oestrous cycle. Luteal tissue appears as distinctly echogenic areas within the ovarian stroma. A central lacuna (fluid-filled cavity) may be seen within a normal CL and should not be confused with the presence of a luteal cyst.
Compared to a luteal cyst, a normal CL with a central lacuna is less than 25 mm in diameter and the lacuna occupies less than one third of the entire CL.

The CL may usually be identified on ultrasound examination 4 days after ovulation occurs. If fertilisation of the ovum does not occur and pregnancy is not established, the CL reaches peak size 16 days post-ovulation and then begins to regress. Therefore, repeated examination of the ovaries can provide useful information regarding stage of the cycle through observation of changes to the CL.

Additionally, persistence of the CL may assist in the determination of early pregnancy diagnosis. The embryonic vesicle can usually be found in the uterine horn ipsilateral to the ovary containing the CL.
Uterus

Non-pregnant uterus

The uterus has different echogenic appearances depending on the stage of the oestrous cycle. Viewing the uterine horn in cross section, where the uterus is circular in appearance may enable the endometrium, myometrium and uterine lumen and its contents to be identified more easily. When the cow is in oestrus, the endometrium becomes oedematous and therefore the endometrial folds become more prominent. The lumen also has a varying appearance depending on intraluminal fluid accumulation at different stages of the cycle. In the periovulatory period, the uterine lumen appears anechoic due to mucus accumulation. It is important to differentiate between the appearance of a large amount of mucus in the uterus and early pregnancy. This can be done through examination of the ovaries for the presence of follicles and corpora lutea in addition to the presence/absence of a foetus, foetal membranes and placentomes (cotyledon/caruncle unit).

Pregnant uterus

Early and accurate identification of the non-pregnant cow is essential to improve the overall reproductive efficiency of the herd. Although the experienced operator may be capable of detecting a pregnancy as early as day 17 post-breeding/artificial insemination (AI), the length of examination time is increased as the entire uterus must be carefully evaluated to confidently diagnose a non-pregnant
state. Additionally, diagnosis of pregnancy at this stage should be considered with caution due to typically high rates of early embryonic loss. Most operators can diagnose pregnancy under farm conditions quickly, easily and accurately by day 30 through the use of transrectal ultrasonography. Therefore, it is generally advisable to perform ultrasound examinations for pregnancy diagnosis around day 30 post-breeding/AI.

A positive diagnosis of pregnancy may be made without visualisation of the embryo on ultrasound examination. This is done through identification of allantoic fluid, foetal membranes and placentomes.
Twins

The development of twin pregnancies in dairy cattle is undesirable due to the resultant reduction in overall herd reproductive efficiency and therefore farm profitability. Twinning in cows may result in higher rates of embryonic death and late term abortion, premature and/or difficult calving and the development of various metabolic diseases such as ketosis. Therefore, early identification of a cow carrying twins is important to minimise potential costs to the farm.

Ultrasound is an effective tool as twin pregnancies can be accurately identified using transrectal ultrasonography by 40–70 days post breeding/AI. It is important to evaluate the ovaries at the time of pregnancy diagnosis as the presence of two or more CL gives an indication of cows which may develop a twin pregnancy.
Foetal sex

Transrectal ultrasonography is useful for determining foetal sex by evaluating the location of the genital tubercle (precursor to the penis and clitoris). Ultrasound can be used to accurately determine foetal sex from day 55–60 post ovulation. The genital tubercle is located between the tail and hind limbs in the female. In the male foetus, it is located just caudal to the point where the umbilicus enters the body. Accurate identification of foetal sex may be useful for dairy herd management programmes.
Reproductive tract pathology

Ultrasonography is also useful for investigating members of the herd with poor fertility due to cyclic abnormalities or pathologic conditions affecting the ovaries and/or uterus. Conditions affecting fertility such as cystic ovarian disease and endometritis/pyometra can be accurately identified and treated appropriately.

Cystic ovarian disease

Cystic ovarian disease is an important condition to consider, particularly in dairy cattle herd management, as it results in abnormal cyclic activity and a subsequent decrease in fertility. This condition is traditionally defined as the presence of fluid-filled structures greater than 25 mm in diameter on the ovary for longer than 10 days in the absence of a functional CL. The two types of ovarian cysts resulting in reproductive/cyclic dysfunction are follicular cysts and luteal cysts. The criteria generally used to define the type of cyst are:

- **Follicular cysts** – smooth, thin wall (less than 3 mm)
- **Luteal cysts** – thicker wall (greater than 3 mm) due to a lining of luteal tissue

However, not all cysts will adhere strictly to these criteria. Therefore, it is important to fully examine the entire reproductive tract and also take into consideration additional criteria such as cow behaviour and plasma progesterone concentrations.
if ultrasound appearance of the cyst does not provide a definitive diagnosis.

**Endometritis/pyometra**

Endometritis is a common condition affecting dairy cattle which negatively affects reproductive performance. Clinical endometritis is defined as purulent or mucopurulent uterine discharge present approximately 21 to 26 days postpartum. Subclinical cases of endometritis may not have uterine discharge, however fertility is negatively affected. Transrectal ultrasonography may be used to evaluate cows for signs of endometritis. Indicators of endometritis on ultrasound exam include accumulation of intrauterine fluid containing echogenic particles [‘snowy’ appearance] and thickening of the endometrium due to endometrial oedema and inflammation. However, ultrasonography alone does not always provide a definitive diagnosis of endometritis.

Pyometra is generally defined as an accumulation of pus within the uterus. Compared to manual palpation, the differences between uterine enlargement due to pregnancy and pyometra are easily recognisable on ultrasound examination. While foetal fluids in the uterus appear anechoic, pyometra appears as distension of the uterine lumen with contents of mixed echogenicity. Additionally, there will be no evidence of a foetus, foetal membranes or placentomes on ultrasound examination of a cow with pyometra.
# Cattle gestational age tables

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Glossary of terms

**Allantois** – an outgrowth of the hindgut of the early embryo which forms a significant part of the placenta

**Anechoic** – the absence of echoes resulting in a black appearance on the ultrasound image

**Anoestrus** – non-occurrence of oestrus so the female is not sexually receptive at any time during the reproductive cycle

**Antrum** – a cavity or chamber

**Caruncle** – fleshy masses on the wall of the uterus which are the points of placental attachment

**Conceptus** – the product of conception at any stage of development, from fertilisation of the ovum to birth; includes embryo/foetus, extraembryonic membranes and the placenta

**Corpus luteum (plural = corpora lutea)** – a progesterone secreting glandular mass in the ovary formed from the wall of an ovarian follicle which has matured and released its ovum

**Cotyledon** – elevations of the foetal membranes (placenta) which adhere to the maternal caruncles

**Echogenic** – containing structures that reflect high-frequency sound waves and thus can be imaged by ultrasonography

**Echogenicity** – the characteristic ability of a tissue to reflect ultrasound waves and produce echoes

**Embryo** – an animal in the early stages of development which has not taken on an anatomical form that is recognisable as a member of the species

**Embryonic vesicle** – the early embryonic vesicle before the allantois has developed and encircled the embryo

**Endometrium** – the mucous membrane lining the uterus

**Foetus** – the unborn young of a mammal that is considered to have identifiable features of a given species

**Follicle** – the ovum and its encasing cells, at any stage of development

**Intraluminal** – within the lumen

**Ipsilateral** – on the same side

**Ketosis** – metabolic disorder characterised by reduced milk yield, loss of body weight, inappetance and possibly nervous signs

**Lumen** – the cavity within a tubular organ

**Luteal** – pertaining to or having the properties of the corpus luteum

**Mucopurulent** – containing both mucous and pus

**Myometrium** – the smooth muscle layer of the uterus

**Oestrous cycle** – regularly occurring periods during which the female is sexually active and receptive (oestrus) separated by periods in which the female is not receptive

**Oestrus** – the time during the reproductive cycle when the female displays interest in mating

**Ovum** – the female reproductive cell which, after fertilisation, is able to develop into a new member of the same species

**Periovulatory** – around the time of ovulation

**Placentome** – the cotyledon plus the caruncle

**Progesterone** – hormone produced by the corpus luteum to promote implantation of the conceptus and maintenance of pregnancy

**Purulent** – containing or forming pus

**Stroma** – the tissue forming the support structure, as opposed to the functional part, of an organ

**Subclinical** – without clinical manifestations
References


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