# Foetal Sex Determination

PEER REVIEWED

Introduction
Foetal sex determination using ultrasonography is being used increasingly on modern-day dairy farms and is now a valuable tool for farm animal veterinary surgeons. It was first described by Müller and Wittkowski in 1986 when they used ultrasonography to look for the male scrotum or female mammary teats between days 70 and 120 of pregnancy, a method now known as late foetal sex determination. Then, in 1989, Curran *et al.* described an alternative method of foetal sex determination, which was carried out between days 55 and 65 of pregnancy and involved determining the location of the genital tubercle, a method now known as early foetal sex determination.

**The Benefits of Foetal Sex Determination**
Although foetal sex determination is an impressive skill to have, it is important that farm animal veterinary surgeons are able to explain the benefits of it to their clients, from a commercial point of view, in order to sell the service on farm. Some of the main benefits are summarised below:

- Pregnancy diagnosis is now frequently carried out at 30 days, instead of the traditional 42 days, allowing non-pregnant cows to be treated and served again as soon as possible. Embryo losses between days 28 and 42 of gestation can be as high as 10-15% (DesCoteaux *et al.* 2009) so there is a risk that early pregnancy diagnosis could miss late embryonic/foetal death, especially if cows are not rechecked or observed for return to oestrus. When foetal sexing is carried out, cows receive a second ultrasound examination, meaning late embryonic/foetal death is more likely to be detected. In addition to this, cows can be examined for twins at the time of foetal sexing and managed accordingly.
- Knowledge of the foetal sex can help when making a decision about the fate of a cow.
- Knowledge of the foetal sex when a pregnant cow is intended for sale could help in determining the value of the cow as a cow carrying a female foetus may be more valuable than a cow carrying a male foetus, especially if the foetus is of high genetic merit.
- Knowing the sexes of dizygotic twins makes it possible to predict the likelihood of a sterile freemartin being born, as 85-90% of females born to male co-twins are sterile freemartins.
- Knowledge of the foetal sex may be helpful when making treatment decisions in cases of dystocia.
- Mee et al. (2011) found that the likelihood of calving difficulty or requirement of assistance was greater for male calves. This is especially true for heifers and is likely to be due to feto-pelvic disproportion. Foetal sex determination gives farmers the option of inducing animals that are carrying male foetuses, especially if they are small-sized heifers, to reduce the risk of dystocia. It should, however, be remembered that induction can itself predispose to dystocia, as a result of foetal malpresentation, and post-calving problems, and farmers should always be warned of these risks.
- Foetal sex determination will give the farmer an idea of the number of replacements likely to be available well before calving occurs, which will allow him to plan culling or heifer sales in advance and to purchase additional animals when available if required.

**Early Foetal Sex Determination**
Early foetal sex determination is carried out between days 55 and 65 of pregnancy by using ultrasonography to determine the location of the genital tubercle. The genital tubercle forms from the cloaca during embryonic development and gives rise to the penis and prepuce in the male and to the vulva and clitoris in the female. It appears on ultrasound as a bilobular, ovoid structure, which is a few millimetres in size and highly echogenic. Tainturier *et al.* (2004) liken it to an equals symbol (=). The genital tubercle is initially located between the hind limbs in both sexes, but after day 50 of pregnancy it begins to migrate towards the umbilicus in the male foetus and towards the tail root in the female foetus. On day 55 it is located halfway between its initial and final position, but by day 60 it has reached its final position, caudal to the umbilicus (see Figures 1. and 2.) in the male foetus and just under the tail (see Figures 3. and 4.) in the female foetus. Additionally, in the male foetus, three highly echogenic lines may be seen close to the genital tubercle, signifying the scrotal sac (see Figure 1.). The genital tubercle is best visualised in either the frontal or transverse plane. In the frontal plane, both possible locations can be visualised at once. In the transverse plane the foetal head should be visualised first and then the probe should be moved caudally from head to tail to ensure both possible locations are visualised in turn. Between days 70 and 75 of pregnancy the genital tubercle in the male foetus becomes hypoechogenic as it forms the penis and is therefore difficult to visualise on ultrasound, making this method of foetal sex determination less useful. A study by Tainturier *et al.* in 2004 found that early foetal sex determination using ultrasonography is both accurate and safe. They concluded that the average success rate for 107 foetal sex diagnoses carried out between days 54 and 69 of pregnancy was 81%, although the success rate for the more certain diagnoses was 92%. They also found that success rate was significantly higher after day 60 of pregnancy when the genital tubercle has reached its final position. The abortion rate of the cows in the study was found to be 2%, which corresponded to the expected abortion rate of cows at the time. It is important to remember that these rates will depend on the skill of the operator.

**Late Foetal Sex Determination**
Although early foetal sex determination is generally favoured,

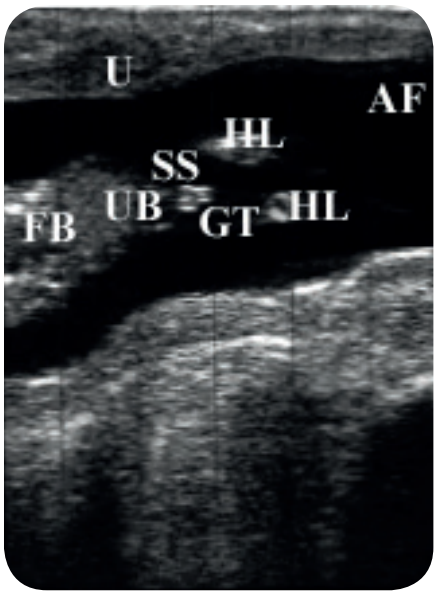


Figure 1. Ultrasound image of a male foetus at 55 days of gestation seen in the frontal plane. Visible structures include: uterus (U), amniotic fluid (AF), umbilicus (UB), hind limbs (HL), genital tubercle (GT) and scrotal sac (SS).

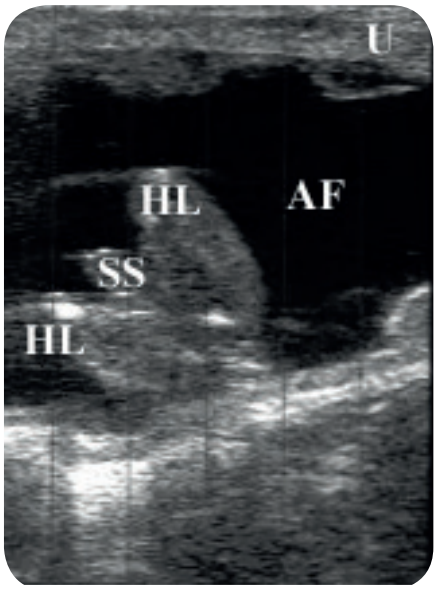


Figure 2. Ultrasound image of a male foetus at 55 days of gestation seen in the transverse plane. Visible structures include: uterus (U), amniotic fluid (AF), hind limbs (HL) and genital tubercle (GT).

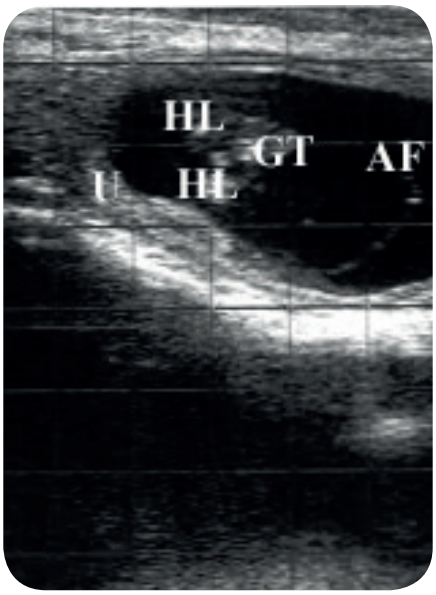


Figure 3. Ultrasound image of a female foetus at 55 days of gestation seen in the frontal plane. Visible structures include: uterus (U), amniotic fluid (AF), foetal body (FB), hind limbs (HL), tail (T) and genital tubercle (GT).

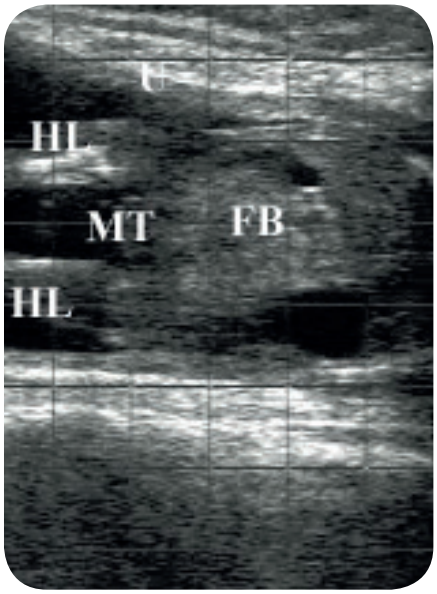


Figure 4. Ultrasound image of a female foetus at 55 days of gestation seen in the frontal plane. Visible structures include: uterus (U), amniotic fluid (AF), foetal body (FB), hind limbs (HL), tail (T) and genital tubercle (GT).

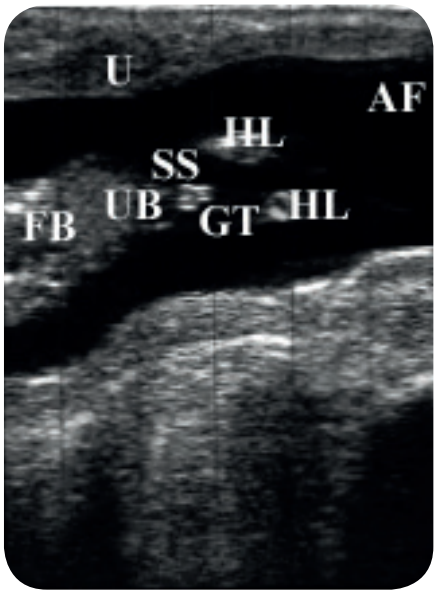


Figure 5. Ultrasound image of a male foetus at 80 days of gestation seen in the transverse plane. Visible structures include: uterus (U), amniotic fluid (AF), hind limbs (HL) and scrotal sac (SS).

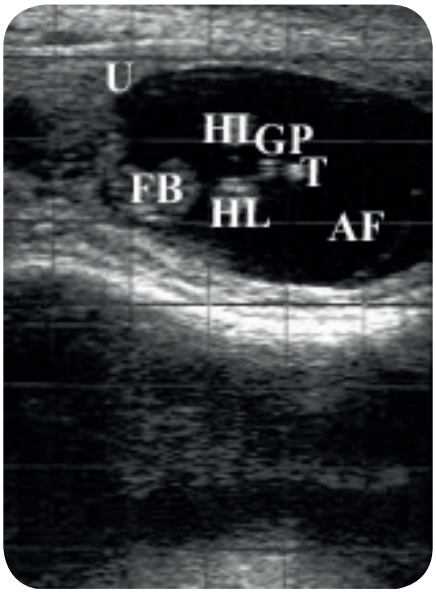


Figure 6. Ultrasound image of a female foetus at X days of gestation seen in the frontal plane. Visible structures include: uterus (U), foetal body (FB), hind limbs (HL) and mammary teats (MT).

*all ultrasound images shown were taken with Easi-Scan from BCF Technology*

late foetal sex determination can be useful if the time window for early sex determination has passed. Late foetal sex determination is carried out by using ultrasonography to visualise the scrotum in the male foetus or the mammary teats in the female foetus. Late foetal sex determination is generally carried out between days 80 and 100 of pregnancy. The scrotum can be visualised between the hind limbs of the male foetus in the transverse plane (see Figure 5.), although care must be taken not to confuse it with the umbilical cord, which should be visualised as a separate structure to prevent confusion. The mammary teats can be visualised in the inguinal region of the female foetus in the frontal plane and appear as four highly echogenic dots arranged in a square (see Figure 6.). To carry out late foetal sex determination, the foetus should be visualised first in the transverse plane, to check for the presence of the scrotum, and then in the

frontal plane, to check for the presence of the mammary teats. Identification of the mammary teats can be difficult, so determining the location of the genital tubercle is more reliable when determining female foetal sex (Kahn and Volkmann 2004). Foetal sex determination is difficult after day 100 of pregnancy as the foetus lies deeper within the abdominal cavity and its larger size makes it difficult to obtain the required sections.

**Conclusion**

Foetal sex determination carried out using ultrasonography is both accurate and safe. Although it is an impressive skill to have, veterinary surgeons must also be able to explain the benefits of it to their clients in order to sell the service on farm. Once it is in place, many find it to be a valuable tool on modern-day dairy farms.

*References*


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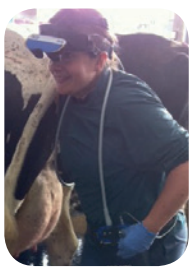

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