

Ultrasound and its role to play in successful embryo transfer

by John Dawson, BVMS, MRCVS, Cert. CHP, Dip. Cattle Hoof Care, Willows Vet Group and Embryonics.

Embryo transfer has been used for many years to quicken the multiplication of superior bovine genetics. Bovine generation length and offspring numbers are such that it takes several years to evaluate the genetic quality of individual animals and many years to achieve the desired quantity of offspring.

Embryo transfer can help speed up the incorporation and distribution of enhanced bovine genetics.

The embryo transfer technique and its success have been established for a number of years and in the hands of experienced operators can be very successfully employed with good results.

Basic flushing (the term used to describe the harvesting of embryos from the donor animal) and the transfer technique used to implant the embryo into the recipient have not changed dramatically for several years.

However, the use of ultrasound has enhanced the identification of suitable donor animals and is a great aid to improving production, yield and quality of embryos.

In addition, it enables the operator to select good quality recipient cows which will positively impact conception rates.

Recruiting the donor

A donor cow is an animal with desirable genetic material that you wish to multiply by passing those superior genetics on to numerous offspring.

The donor has to be in tip top condition to produce an adequate number of good quality embryos.

This requires an animal which is in good condition but not overfat, is on a very good plain of nutrition, is not stressed and is cycling normally.

A thorough examination of the reproductive tract of the cow is essential to assess if these criteria are being met.

A key aspect of this examination involves using ultrasound to evaluate the status of the uterus and ovaries and their suitability for embryo collection.

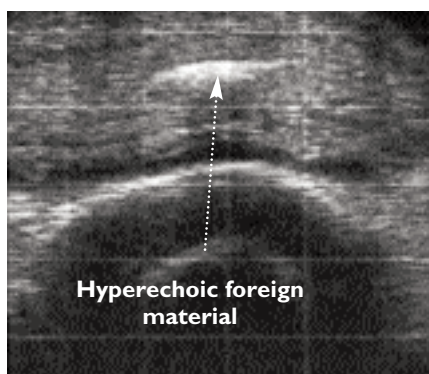


Fig. 1. Endometritis. The hyperechoic foreign material (arrows) is easily seen in the uterine lumen. Ultrasound image obtained using BCF Easi-Scan.

Three structures are examined closely when scanning the reproductive tract of the cow – the cervix, uterus and ovary.

The cervix

The cervix is examined for patency and lack of damage from calving. It is essential that the cervix can be manipulated and catheterised during the insemination and flushing stages of the embryo transfer process.

The uterus

The uterus is examined in detail for post-calving damage and traces of endometritis (whites) hidden deep in the uterine horn. Detailed, methodical examination of the uterus with the ultrasound machine helps identify low grade endometritis which can be seen as small pockets of hyperechoic material (Fig. 1) and is usually identified near the tips of the uterine horns.

Endometritis can easily be missed with manual palpation, particularly when it is low grade.

Cows with low grade endometritis do not have vaginal discharges and therefore any vaginal mucous seen or removed at the time of examination will not reveal the endometritis.

In fact, this type of low grade endometritis

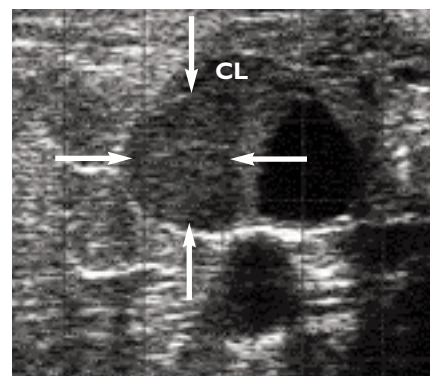


Fig. 2. First class corpus luteum (CL) with the classic even echogenic appearance. Ultrasound image obtained using BCF Easi-Scan.

may only be identified at the embryo flushing stage, at which point it is too late and expense and time have already been lost.

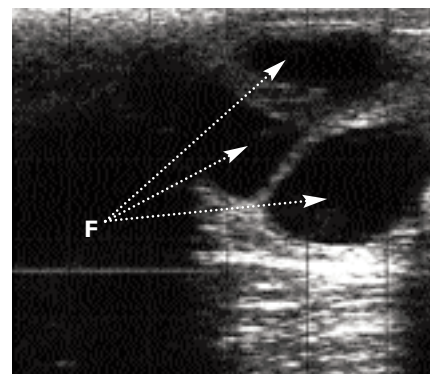
The ovary

Detailed examination of the ovary can only be done with the use of ultrasound. The size, quality, and appearance of the corpus luteum and follicles help determine the donor's cyclicity.

A first class corpus luteum needs to be

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Fig. 3. Poor quality embryo transfer donor choice with three large follicles (F) greater than 1.5cm diameter and uneven shapes. Ultrasound image obtained using BCF Easi-Scan.



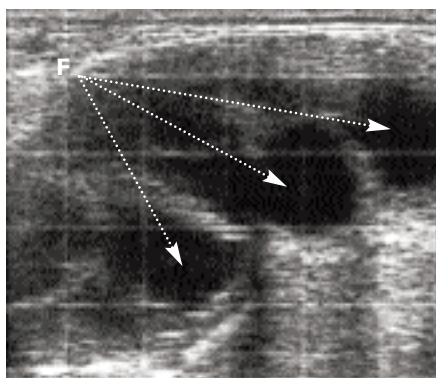


Fig. 4. Super-ovulated ovary 18 hours prior to ovulation showing 3 x 1.5cm even sized follicles (F) in the one plane. Ultrasound image obtained using BCF Easi-Scan.

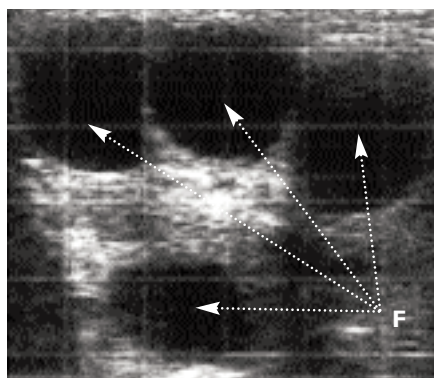


Fig 5. Super-ovulated ovary just prior to ovulation showing four very good 2cm diameter, even shaped follicles (F) in the one plane. Ultrasound image obtained using BCF Easi-Scan.

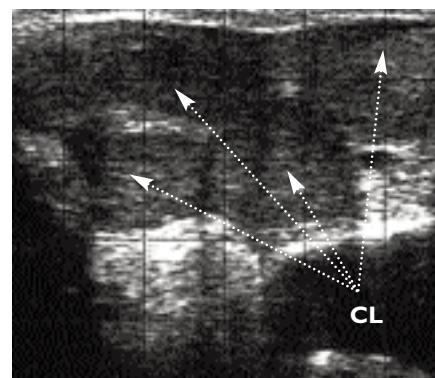


Fig. 6. Four good quality, even sized corpora lutea (CL) can be seen on this ovary. Signs of a good super-ovulatory response. Ultrasound image obtained using BCF Easi-Scan.

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2cm in diameter or larger, be solid or with only a small lacuna, and have an acceptable consistency/echogenicity (Fig. 2). The follicles need to be such that there are not too many large follicles. Multiple follicles over 15mm in diameter are suggestive of a donor which may give a suboptimal response to the embryo transfer protocol (Fig. 3).

These ovaries with multiple large follicles are often seen in cows which are towards the end of their lactation or even dry and over fat. Slimming these cows to a lower

body condition score can help embryo yields.

After the careful selection of the donor animal and examination to ensure the best chance of success, the next stage where strategic incorporation of ultrasound should take place is at the time of insemination.

Donor insemination

Ultrasound examination of the donor cow at time of insemination, when the ovaries

have been stimulated to produce multiple follicles which house the eggs, is of great benefit to determine the number and quality of the eggs and therefore the quality of the response to the embryo transfer protocol.

The use of ultrasound at this time is essential to minimise potential trauma to the ovarian structures.

The examination can be done by gently passing the ultrasound probe into the cow's rectum and the image obtained by holding the probe over the ovary. Manual palpation at this time can disturb the follicular growth and ovulation, causing premature ovulation and loss of the egg.

In addition, ultrasound examination is the only method which allows counting of the follicles and examination of their size and quality (Fig. 4).

A good response by the donor animal produces multiple follicle of an even size. These follicles reach approximately 2cm diameter just prior to ovulation. Size variation does occur but the greater the size discrepancy, the more variable the ovulation response which affects the numbers and quality of the eggs.

If the donor animal is at an embryo transfer centre, serial examinations of the ovary can be done. This is of great benefit in the super-ovulated cow as examination of the follicular quality and size can enable the time of ovulation to be determined which influences the timing of insemination.

If there is no evidence of a positive response to the super-ovulatory drug at the time of the pre-insemination ultrasound examination, which can be the case, this embryo transfer programme can be stopped in these cows.

Correctly identifying these cows at this point of the programme is beneficial as it saves the cost of expensive semen.

An ultrasound examination at onset of the super-ovulated oestrus sets the picture of how many follicles have been recruited by the superovulatory drug and are maturing towards ovulation (Fig. 5).

Further ultrasound examinations at specific intervals, enables the progress of follicular

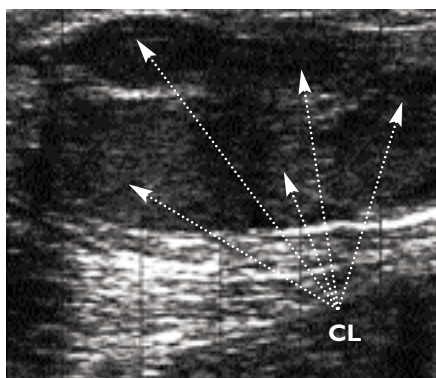


Fig. 7. Five good quality, solid corpora lutea (CL) can be seen on this ovary. Signs of a good super-ovulatory response. Ultrasound image obtained using BCF Easi-Scan.

maturation and ovulation to be visualised.

Most follicles ovulate at the end of the oestrus period and after behavioural signs have ceased.

Therefore if the number of examinations is limited for some reason, the late examination is the most important.

The day of collection

Once all the hard work of super-stimulation and serial insemination has taken place, the cow is left to culture the multi-ovulated eggs until day seven after the inseminations.

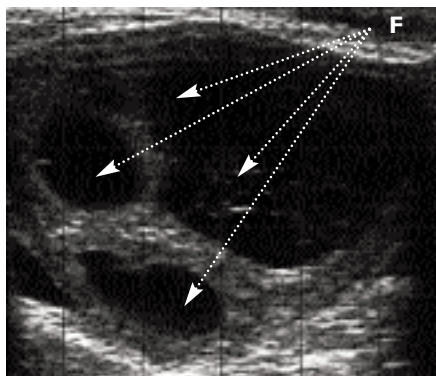
To ensure good quality embryo development takes place, it needs to be in the presence of good progesterone levels. The corpus luteum which forms in the place of the ovulated follicle produces progesterone and can easily be identified by ultrasound.

These structures have a distinct echogenic appearance (Fig. 6 and 7).

One corpus luteum develops for every potential embryo produced. Therefore counting the number of corpora lutea on the ovaries can give a good indication of the expected yield of embryos. A good average response with good quality eggs produces four to six eggs per ovary.

In some cases a few unovulated follicles can be seen on flushing day (Fig. 8).

Fig. 8. A poor response showing un-ovulated follicles (F) in this image.



This is common and as long as there are only one or two unovulated follicles per ovary, their production of oestrogen is usually not sufficiently high enough to over-ride the progesterone influence of embryo development.

The assessment of the ovaries and the presence and numbers of corpora lutea on the day of collection (or the day before) helps identify potential numbers of embryos to be collected, how good the response has been and the potential quality of the embryos.

Once the flushing process has taken place and the eggs have been counted, they should correlate to the number of corpora lutea observed on the ovaries.

If the embryo number and quality do not correlate, that information can be used to identify the embryo production problem.

Rewarding procedure

Embryo transfer can be a very rewarding procedure reaping multiple calves from the best cows which hastens the incorporation and spread of their superior genetic material in both the national and international herd. This can be highly beneficial to the development of the breed.

In summary, careful selection, treatment and examination of the donor cow are essential for embryo transfer success. ■