Research Summaries I & II:

Dairy

Moderators - Mark Kinsel
Dale Moore

Predictive Values of Early Pregnancy Diagnosis by Ultrasonography in Dairy Cattle

Virginie Filteau, *DMV,* **Luc DesCôteaux,** *DMV, M.Sc., Dipl. ABVP (Dairy)*
Département de Sciences cliniques, Faculté de Médecine vétérinaire
Université de Montréal,C.P. 5000, Saint-Hyacinthe,
Québec, Canada, J2S 7C6

A retrospective study was conducted in 15 Holstein dairy herds to determine the accuracy of detecting pregnancy with an ultrasound scanner between 22 and 40 days post-artificial insemination. The selected herds were on a computerized herd health program with the Faculty of Veterinary Medecine at the University of Montreal. All ultrasound pregnancy diagnoses were made between December 1st 1994 and May 15th 1997 and information was treated with the DSA software (Dossier de Santé Animale ; Animal Health Record, version 4.2[a]). The pregnancy diagnoses were performed by a clinician or post-graduate students (4) with a portable real-time B Mode ultrasound scanner ECHO 1000 (Alliance Medical Inc[b]), with a 5 MHz transducer. Positive pregnancy diagnosis was based on the visualisation of liquid in the uterine horn and/or the demonstration of an embryo. Negative pregnancy diagnosis was based on the absence of fluid in the uterus. The animal health record of each cow was examined to established the number of days post-insemination at the time of ultrasonographic examination. The confirmation of ultrasound diagnosis was made by a follow-up transrectal palpation after the 40th day post-breeding. A cow was considered not pregnant if, subsequently to positive ultrasound pregnancy diagnosis, one of the following events was reported in her record : presence of metoestral blood, artificial insemination and/or determination of non-pregnancy after a reproductive examination. Cows that received prostaglandins or were culled soon after the ultrasound scanning examination were excluded from the study.

Four hundred and thirty-five (435) ultrasound scanning examinations, performed on 352 animals, were considered. Average parity was 2.7 with a range from 0 to 12 lactations. Average days post insemination at the time of the ultrasound diagnosis was 29.3 ± 3.1 s.d.. The overall accuracy, sensitivity, specificity and positive and negative predictive values were respectively 89.2%, 96.2%, 71.1%, 89.6% and 87.8%. The overall pregnancy rate was 72.0%.

Table 1 shows predictive values, sensitivity and specificity of ultrasound pregnancy diagnoses by days post-insemination. The early embryonic death rate between days 26 and 40 was estimated at 10% ± 5%, using the formula (1 - positive predictive value). If positive pregnancy diagnosis was based only on the visualisation of an embryo, the early embryonic death rate decreased to 6% ± 5% (n=362) for the same period of time. The early embryonic death rate was statistically independent of days post-insemination ($0.1<p<0.05$, $\alpha = 0.05$) for this period. Figure 1 shows the estimated early embryonic death rate by days following insemination at the time of the ultrasound diagnosis.

Table 1. Predictive values, sensitivity (Se) and specificity (Sp) of pregnancy diagnoses assisted with portable ultrasound scanner using a 5 MHz transducer by day post-insemination in dairy cows.

DPI[a]	22 to 24	25	26	27	28	29	30	31	32	33	34 to 40
n	14	26	43	47	46	58	58	41	35	32	35
Accuracy (%)	35.7	80.8	88.4	91.5	95.7	94.7	87.9	90.2	88.6	90.6	88.6
PPV[b] (%)	40.0	81.3	91.2	94.3	94.7	97.9	84.8	90.3	86.2	89.7	84.0
NPV[c] (%)	66.7	80.0	77.8	83.3	100	77.8	100	90.0	100	100	100
Se[d] (%)	40.0	86.7	93.9	94.3	100	95.9	100	96.6	100	100	100
Sp[e] (%)	66.7	72.7	70.0	83.3	80.0	87.5	63.2	75.0	60.0	50.0	71.3

[a] DPI: days post insemination
[b] PPV: positive predictive value = (number of correct positive diagnoses/ number of correct positive diagnoses + number of incorrect positive diagnoses)
[c] NPV: negative predictive value = (number of correct negative diagnoses/ number of correct negative diagnoses + number of incorrect negative diagnoses)
[d] S: sensitivity = (number of correct positive diagnoses/ number of correct positive diagnoses + number of incorrect negative diagnoses)
[e] Sp: specificity = (number of correct negative diagnoses/ number of correct negative diagnoses + number of incorrect positive diagnoses)

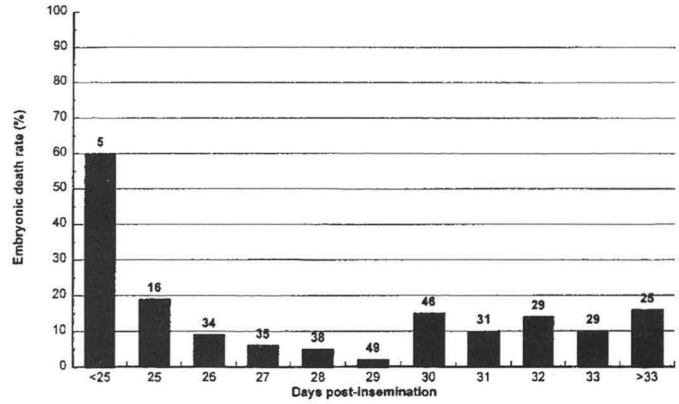

Figure 1. Estimated early embryonic death rate in dairy cows by day following insemination at the time of ultrasound diagnosis. (Total number of positive ultrasound diagnoses for each day following insemination appears above bars of histogram).

The results of this study suggest that it is possible for the bovine practitioner to accurately detect pregnancies as early as 26 days following insemination with a portable 5 MHz ultrasound scanner. However, one should be aware that embryonic death during this period could represent a significant source of diagnostic error. It is then strongly recommended to advise clients of this reality and to reconfirm pregnancy after 40 days. Futhermore, since there is approximately 20% probability of false negative diagnosis before 28 days post breeding with this method, it is recommended not to induce heat before this time unless other factors that influence the diagnostic accuracy are considered. These factors are uterus position, age of cow, type of ultrasound scanner and probe, and experience of the practitioner. Finally, the results of this study would suggest that a threshold of 30 days following insemination should be considered for less experienced veterinarians using ultrasound as a diagnostic tool for pregnancy in dairy cows.

Footnotes

[a]DSA, version 4.2 (1997), ASTLQ inc., Faculté de médecine vétérinaire, Université de Montréal, Québec, J2S 7C6.
[b]ECHO 1000, Alliance Medical inc., Montréal, Québec, H4R 1B7.