Student Session

Use of arm-free devices in bovine reproductive ultrasound

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Abstract

Ultrasonography has been employed in bovine practice since the 1980s for visualizing and evaluating the reproductive tract, diagnosing pregnancy, identifying anomalies, and determining the age and gender of a fetus. The modality has advanced quickly since then, introducing new technologies, techniques, and equipment to facilitate its use and improve its accuracy and efficacy. Among these advancements is the advent of arm-free ultrasound with the use of a transducer handle, which allows the user to conduct an ultrasound exam without inserting his or her arm into the rectum of the animal. The intention is to increase exam speed, decrease animal discomfort, improve reach, and reduce chronic and overuse injuries to the operator. We conducted a survey to determine why and how ultrasonographers employ this tool, whether they had experienced any negative consequences from its use, and what effect it has on their reproductive practice.

Key words: reproductive ultrasound, arm-free, pregnancy diagnosis, imaging

Résumé

L'échographie a été utilisée en pratique bovine depuis les années 80 pour visualiser et évaluer le tractus reproducteur, pour le diagnostic de la gestation, l'identification d'anomalies et la détermination de l'âge et du sexe du fœtus. Cette modalité d'imagerie a progressé rapidement depuis en introduisant de nouvelles technologies et techniques et de nouveaux équipements pour faciliter son utilisation et améliorer sa précision et son efficacité. Parmi ces développements, on note l'arrivée de l'échographie sans l'intervention du bras à l'aide d'un transducteur avec poignée qui permet à l'utilisateur de faire un examen échographique sans avoir à insérer son bras dans le rectum de l'animal. L'idée derrière étant d'augmenter la vitesse de l'examen, de diminuer l'inconfort de l'animal, d'améliorer la portée et de réduire les blessures chroniques et la surutilisation par l'opérateur. Nous avons mené un sondage afin de déterminer pourquoi et comment les échographistes utilisent cet outil, s'ils avaient subi des conséquences négatives suite à son utilisation et l'impact de l'échographie sur leur pratique en reproduction.

Introduction

Due to the size, conformation, and management of large quadruped species such as cattle and horses, reproductive ultrasound is conducted transrectally, imaging through the ventral rectal wall to visualize the cervix, uterus, ovaries, and associated structures. This method presents its share of challenges, including the need to minimize risk of physical harm to both the animal and operator, to set up an efficient and safe facility for conducting exams on large numbers of animals, and to reach the fetus effectively in a large or late-gestation individual. Over a decade ago, veterinary ultrasound manufacturers began to offer devices that allowed the operator to insert the transducer ("probe") into the rectum without also inserting their hand and arm. These devices take the form of a handle, extension, or introducer that holds the transducer array in the proper position to image ventrally into the reproductive tract. The size and shape of such devices vary to some degree, but the concept is consistent across brands.

At the same time, manufacturers were developing low-frequency, curved linear (convex) rectal probes in order to visualize wider areas and deeper tissues. While traditional flat linear rectal probes produce a rectangular image, operate in the approximately 5 to 8 MHz range (often variable frequencies), and achieve a depth of around 3.9 to 4.7 in (10 to 12 cm), modern convex rectal probes produce a wide, pie-shaped field of view, operate from about 2 to 6 MHz, and image structures up to 11.8 in (30 cm) beneath the surface of the array. The lower frequency range of these transducers can compromise fine resolution to some degree, but depth of penetration is generally the priority.

While an assortment of arm-free devices (we will refer to them as AFDs to avoid brand bias) are available on the market for both traditional and curved rectal probes, the convex transducers work particularly well in an arm-free scenario because the curved probe surface naturally makes good contact with the rectal wall, requiring less leverage applied to the end of the handle in order to obtain a clear image. In addition, because the operator's arm is not inside the animal and tactile evaluations are not made, the wider field of view and deeper penetration improves the confidence of the operator that he or she has seen the full extent of the reproductive tract with a simple side-to-side sweeping motion of the AFD.

The initial target audience for this type of exam was the beef practitioner or producer. Because beef operations are generally less intensively managed than dairy, pregnancy diagnosis is often only conducted once or twice per year, yielding a wide range of gestations (often with a majority of them being 120+ days depending upon management and scheduling). By contrast, in a typical dairy scenario, early diagnosis, ovarian evaluation, and fine detail such as fetal gender determination and accurate aging often dictate that a hand-operated linear probe be used so that the structures are more easily manipulated and more specific views obtained.

That said, arm-free ultrasound techniques have been adopted for use in many species and for many reasons. We at EIMI conducted a survey of a small sampling of arm-free device customers in order to obtain more information about their motives and results in employing this technique. It is important to note that these results came from people using only 1 brand of ultrasound with the corresponding arm-free device for that equipment, and that many other similar devices are available for a variety of brands in today's market.

Survey of AFD Users

The results of the survey are as follows (N = 26) [96 were invited to participate]:

1) Twenty two of 26 (84.62%) respondents currently use the arm-free device (AFD) for their bovine reproductive exams. Those that do not cited that it was not ideal for fetal gender determination, that it slowed them down when they tried it, and that they didn't care for it when they tried it because they felt that it was large and heavy or cumbersome in some way.
2) Respondents were asked to classify the type of bovine reproductive work they do: 84.62% (22/26) selected cow/calf, 23.08% (6/26) selected private practice (mixed applications), 15.38% (4/26) selected feedlot, 11.54% (3/26) selected dairy, and 7.69% (2/26) selected sale barns.
3) The numbers of cows examined annually varied from 250 to over 50,000, with 1 respondent not using an AFD at all and 1 citing "heifers only" without a number assigned. Regarding number of animals examined, 15.38% (5/26) examine between 250 and 1000 annually, 34.62% (9/26) examine between 1000 and 5000 annually, 3.85% (1/26) examine between 5000 and 10,000 annually, 26.92% (7/26) examine 10,000 to 20,000 annually, and 3.85% (1/26) examine over 50,000 animals annually.
4) Regarding the type of probe used, 65.38% (17/26) of respondents use their AFD with a low frequency, convex rectal probe. 26.92% (7/26) use a linear rectal probe. One person (3.85%) uses both, and 1 person (3.85%) replied that they were not using the AFD.
5) Respondents were asked to classify what kind of reproductive exams they were doing with their AFDs, and 80.77% (21/26) use it for mid-gestation pregnancy diagnosis from 55 to 120 days, 73.03% (19/26) for early pregnancy diagnosis from 25 to 55 days, 69.23% (18/26) for late pregnancy diagnosis from 120 days on, 19.23% (5/26) for subjective fetal aging, 15.38% (4/26) for fetal gender determination, 11.54% (3/26) for fetal aging using measurements and gestation tables, 7.69% (2/26) for ovarian evaluation, and 3.85% (1/26) for breeding soundness examinations (BSEs). None of the respondents were using the AFD for high-risk pregnancy evaluations, and 1 person (3.85%) replied that they were not using the AFD.
6) Respondents were asked about the reasons that they chose to use an AFD, and 76.92% (20/26) said they use it for exam speed, 34.62% (9/26) use it for cleanliness, 30.77% (8/26) have a large arm and/or examine smaller animals (heifers, camelids, etc), 15.38% (4/26) work in a facility in which the AFD is necessary due to setup, 7.69% (2/26) have an injury or condition that precludes them from using their arm, and 7.69% (2/26) examine species that require the use of an extension. Three respondents (11.54%) cited less wear and tear on the body and/or ease of conducting exams on consecutive days without pain or injury. One respondent (3.85%) does not use the AFD.
7) Twenty of 24 (83.33%) respondents use their AFD on cattle only, while 8.33% (2/24) use it on small ruminants. One respondent each (4.17%) reported using their AFD to examine miniature horses, bison, and all equines, but none use an AFD to examine camelids, deer, or other species.
8) When asked about exam speed, 42.31% (11/26) of respondents say that the use of an AFD increases their speed, but 23.08% (6/26) report no effect on their exam speed, 19.23% (5/26) say it slows them down, and 15.38% (4/26) say that it slowed them down initially, but they are now faster than they were with their arm.
9) Twenty one of 25 (84%) respondents report that they have experienced no complications from the use of an AFD, although 1 of these offered the disclaimer that he or she was using the device in a feedyard with no opportunity for follow-up. Three respondents (12%) had caused rectal trauma or perforations that could be medically managed, 1 (4%) had a rectal perforation resulting in the death of an animal, 1 (4%) reported mild rectal irritation, and 1 (4%) reported that they do not

use an AFD. No one reported rectal perforations that were surgically managed, and none reported fetal compromise or death.

10) The final survey question involved feedback for our engineering and manufacturing teams. While these responses may be specific to our brand, I feel that they represent thoughts on the application of many AFDs available on the market. Responses suggested that satisfaction with such a device is largely affected by personal preference. For example, several people suggested that the device is too long and/or heavy to be comfortably used for long periods, yet 1 person suggested that it would need to be even longer to reach later pregnancies in large animals. There were suggestions about the materials used in manufacturing, the durability of various components, and feedback about pricing.

Conclusion

Arm-free devices (AFDs) provide an additional option for transrectal reproductive ultrasonographic exams of cattle, and in some cases other species. Various designs are employed by different manufacturers to suit their equipment's transducer shape and their customers' requirements. While beef practice (including cow/calf, feedyard, and sale barn) is perhaps the predominant environment for this modality, it has been successfully adapted to a variety of purposes and employed for a variety of reasons. Practitioners considering the implementation of arm-free ultrasonography to their reproductive exams should consider the properties of the animals and facilities they will be working with, the specific goals of the examinations they will be conducting, and the brands and features of the ultrasound equipment they will be using in order to determine the transducer type and relevant accessories that will serve them best.

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