

SENIOR PROJECT APPROVAL PAGE

TITLE: Training Manual and Protocol for Ultrasound at Cal Poly

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Training Manual and Protocol for Ultrasound at Cal Poly

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I want to acknowledge my parents Russ and Sandy. My grandparents especial my grandfathers Jim and Case without them I would not be interested in dairying.

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INTRODUCTION

Finding and diagnosing pregnancies and cystic ovaries are critical to the success of dairy farms. In order for the dairy cow to be profitable a farmer needs to get her pregnant and back to peak milk as soon as possible. With cystic cows this prevents her from coming into a proper heat, therefore preventing her from getting pregnant. Hand palpation by the veterinarian is the most common way that dairy farmers have used to diagnosis pregnancies and cystic ovaries. With the consistency of the veterinarians most dairy farmers do not have to worry about the accuracy of the diagnosis. At Cal Poly Dairy this is a problem, with the veterinarian coming only every three weeks.

With the veterinarian coming only every three weeks the dairy cannot effectively evaluate if cows are cycling and coming into heat if they are not pregnant. This makes cows longer to get pregnant thus making them less profitable. Cal Poly being a student ran dairy, teaching them to hand palpate cows could be a viable option. But this takes a lot of time and practice on hundreds if not thousands of cows. On a small dairy like Cal Poly this could take a couple of years to get that experience. A solution to this is to use an ultrasound machine for pregnancy diagnosis as well as teaching.

With the ultrasound machine a student can see what they are feeling inside the cow instead of guessing. This project will set up a protocol and training guide for students to become proficient in the use of the ultrasound. It will also explore options on how to be used in the Cal Poly Dairy Operation.

LITERATURE REVIEW

With the emphasis on a dairy to make the cow more efficient, dairies need to be able to get cows pregnant as quick as possible. This is done through proper artificial insemination practices and weekly palpations usually done by a trained veterinarian. Through recent technology break thoughts veterinarian and some dairies themselves have purchases transrectal real-time ultrasonography machines. They have become lighter and battery packed making them easier and practical for use in large scale dairy operations. Cal Poly is a recent recipient of one of these machines. With no such protocol or training manual for student to become proficient in using such a machine this is what this project is about. In turn this will help by decreasing the interval between A.I. services and increasing the A.I. service rate.

Ovary Structures

First we need to look at the cow and what is going on with her ovaries pre breeding and post breeding and into conception. And how an ultrasound can be used to diagnosis whet stage she is in. The cow goes through a 21 day cycle as the figure below shows the cycle of the ovary. The ovary will start to produce multiple follicles but one dominant one will persists and develop make the others undergo atresia. Within ten days the next groups of follicles begin to develop and the process is repeated. Under normal circumstances follicular cycles ensure that only one follicle is

capable of undergoing ovulation. Most lactating cows go through a two follicular wave cycle whereas heifers undergo a three wave cycle (5).

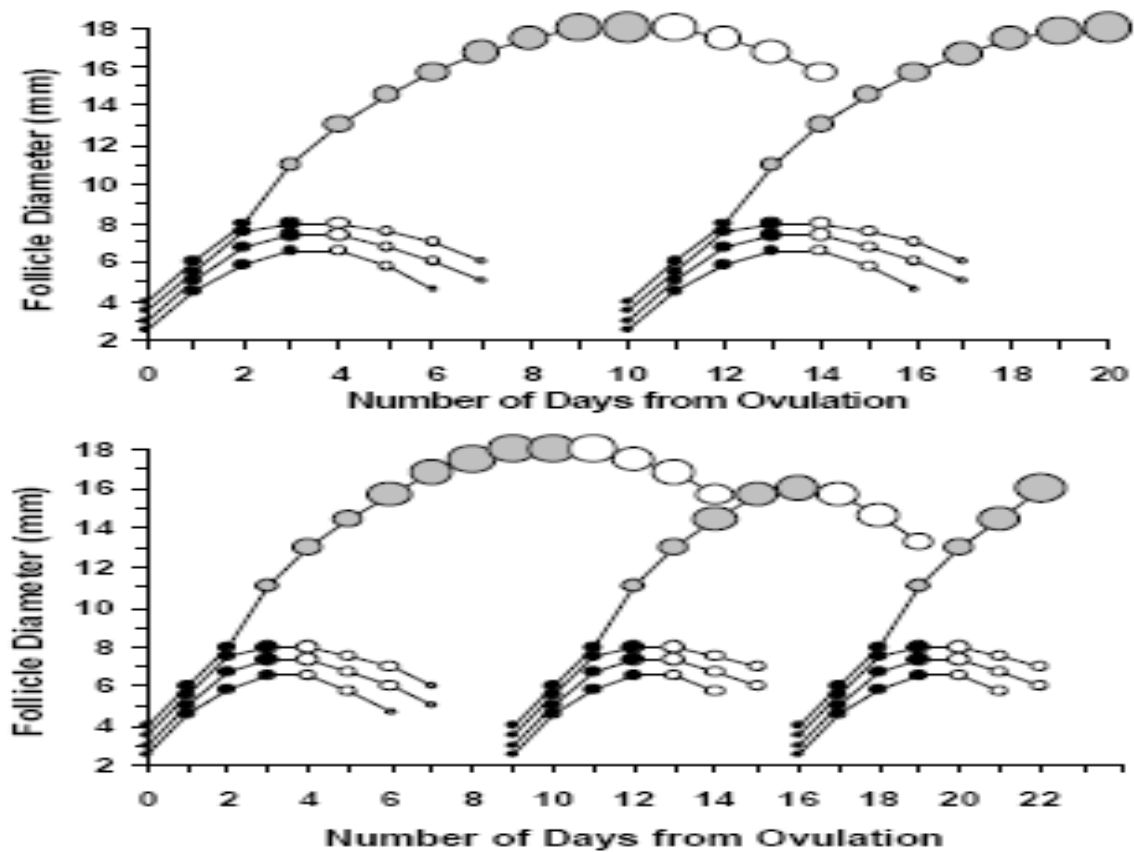


Figure 1. The follicular waves in lactating cows then in heifers (6).

This follicle would then ovulate and with male gametes present become an embryo and later a fetus. The ovary with then luteinize and produce a corpus luteum (CL).

The detection of the CL can be used to detect an early pregnancy but shouldn't be used until a live calf can be seen. Although both ultrasound and regular hand palpation can detect CL they both cannot detect whether it is a regressing CL which will not hold the pregnancy.

Ovarian Cysts

Ovarian cysts are of a concern to a dairy producer as it prevents the cow from performing the regular follicular cycle as described above. Regular hand palpation can detect the structure of an ovarian cyst. An ultrasound can determine the type of cyst with 90% accuracy of luteal cyst and 75% of follicular (4). The determination between the two can mean the difference in the type of treatment to give the cow.

Early Pregnancy Diagnosis

From all the studies out there to accurately diagnosis pregnancy using ultrasound can be done as early as 25 to 28 days. With this there must be a great care taken to ensure an accurate diagnosis. As the shape of the uterus and closeness to the pelvic region make it hard to detect at this early stage of fetus development. The following table shows the different fetus characteristics that an ultrasound can pick up and days post conception they can be seen.

Table 1. Days of detection of fetus characteristics (2).

Characteristic	First day detected	
	Mean	Range
Embryo proper	20.3	19 to 24
Heartbeat	20.9	19 to 24
Allantois	23.2	22 to 25
Spinal cord	29.1	26 to 33
Forelimb buds	29.1	28 to 31
Anmion	29.5	28 to 33
Eye orbit	30.2	29 to 33
Hindlimb buds	31.2	30 to 33
Placentomes	35.2	33 to 38
Split hooves	44.6	42 to 49
Fetal movement	44.8	42 to 50
Ribs	52.8	51 to 55

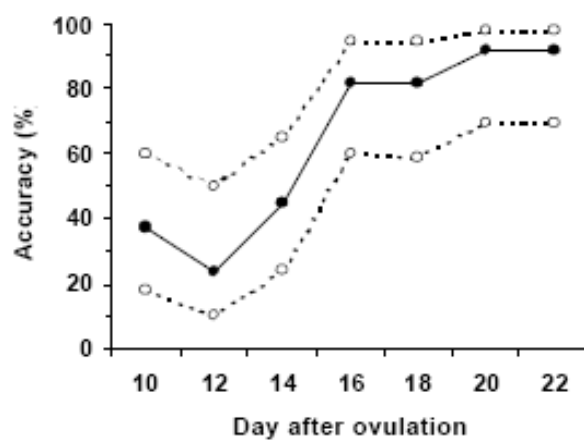


Figure 2. The rate of diagnosis accuracy of fetus using ultrasound (5).

The figure above shows that the dotted lines are the lows and highs of accuracy rates with the mean at 22 day post breeding at 95% accurate.

Early Embryonic Loss

A problem that is faced by dairy producers is that early embryonic loss is high between 28 to 34 days with early detection with ultrasound and 34 to 42 days as a normal time for regular palpation. It isn't well understood why the embryos regress during this period but studies do show that using an ultrasound is no less as invasive as regular palpation (1). Figure 3 shows a study and the rate of loss between 28 to 42 days could range from 10.9% down to .75%. This wide range but needs to be considered in if pregnancy checking earlier than 34 days

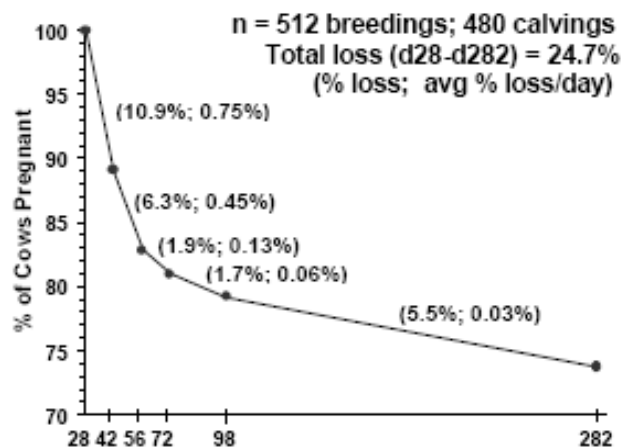


Figure 3. The rate of early embryonic loss and days post breeding (5).

Identification of Cows Carrying Twins

Twins occur about 2.5 to 5.8% of the time in dairy cattle and an ultrasound can detect twins sooner and more effectively(5). Twins usually occur through double ovulation and they will be in the same horn of the uterus. The rate of loss of twins in the same horn between 28 to 45 days is higher than that of a single embryo. With an ultrasound you are able to determine the viability of the embryos and make the management decision to recheck the pregnancy at a later date to reconfirm the pregnancy.

Fetal Sexing

Ultra sound also gives one advantage in that it can determine with an experienced technician the sex of the fetus. This can usually occur around 55 to 90 days post breeding. Once the fetus goes over 90 days the uterus drops and makes scanning more difficult harder. This process, although time consuming can be used in a management situation with cows that are of high value or later in lactation when culling is a consideration.

So this literature review has shown some of the applications of an ultrasound can do as a management tool on a dairy. This should be considered with discussion between the dairy producer and his/her veterinarian. The rest of this paper will be devoted to a training manual and a Standard Operation Procedure (S.O.P.) for the application on the Cal Poly Dairy.

MATERIAL AND METHODS

The equipment that will be used is the Ibex[™] Pro series of portable ultrasound machine. Also the most important parts of the users guide provided by E.I. Medical, as well as two DVD's "Bovine Reproductive Ultrasonography" and "Bovine Fetal Sexing".

Ibex[™] Pro Portable Ultrasound



Figure 4. The Ibex Pro portable ultrasound(3).

The User Manuel



Quick User's Guide

Ibex™ Portable Ultrasound

E.I. Medical Imaging®
Portable Ultrasound Solutions



Figure 5. The Quick User's Guide(3).

Important Features



Figure 6. The left port is for the eye piece cord and right is for the transducer probes(3).

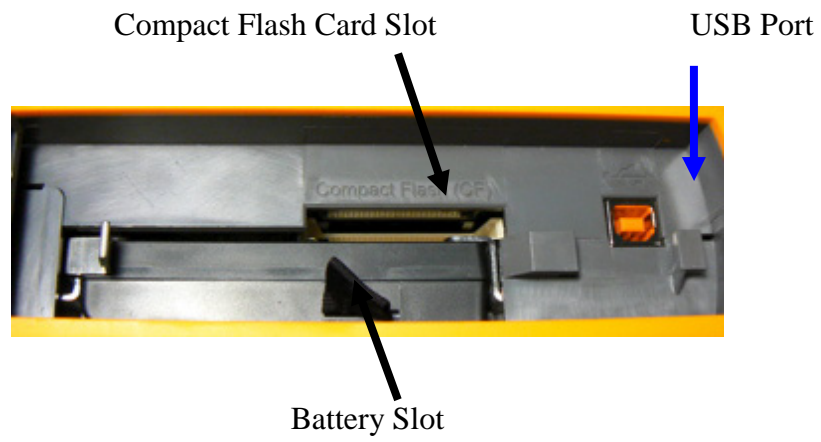


Figure 7. Internal battery compartment(3).



Figure 8. Heads up display when machine is on (3).



Figure 9. The headset for the ultrasound (3).



Figure10. Machine in portable carrying case (3).

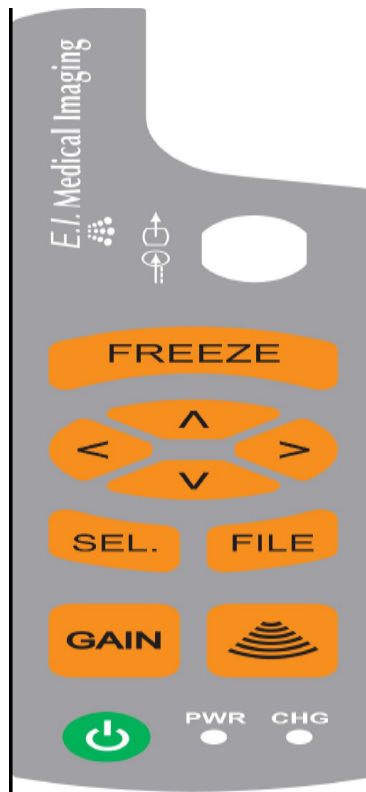


Figure11. Side Keyboard Buttons (3).

Button Names and Operations

This is the names and operations for the button in the above Figure 8.

FILE – Pressing the FILE key opens the File Menu screen. Using the up/down arrows, select a file to preview. Pressing Sel. allows you to recall or delete the selected image, or cancel to return to the file menu.

SEL. – Pressing the SEL. activates the on-screen menus.

FREEZE - Press the FREEZE key to freeze and unfreeze the active image on the screen. There are FRZ keys located on selected probes. **Field of View (FOV)** – This key cycles the ultrasound through 25%, 50%, 75%, and 100% of the probe's maximum scan depth. Reducing the field of view displays greater detail for the visible area.

GAIN – Pressing the GAIN key from an active scan opens the gain settings slider controls. In any text entry fields, pressing GAIN displays the on-screen keyboard. This allows access to both upper and lower case characters, along with numerals and special characters.

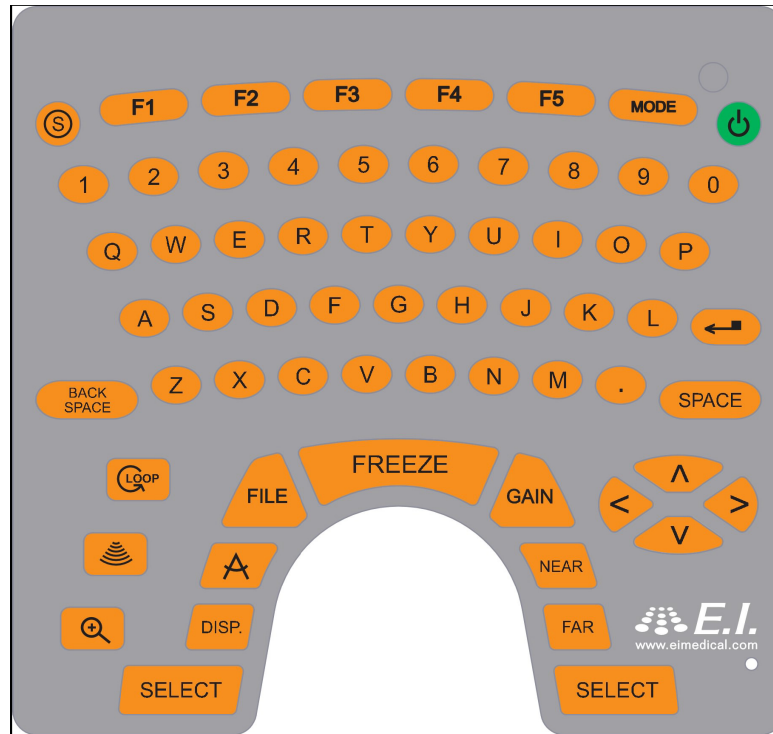


Figure 12. The keyboard for the Ibex Pro (3).

This is the names and operations for the buttons on above figure 9.

SUPER – Pressing the super key returns the system to active scan mode (B or B+M). Pressing the super key returns you to the Startup Menu. Pressing the super key from B mode enters the super menu. You can access all the system option (F1), preset (F2), setup(F3), and help (F5) menus from the super menu.

LOOP – The LOOP key replays up to eight seconds of ultrasound scans, or a total of 240 frames. To return to active scanning, press the LOOP key again. To pause replaying an ultrasound, press the FEEZE key. Pressing FREEZE again resumes active scanning.

Field of View (FOV) – This key cycles the ultrasound through 25%, 50%, 75%, and 100% of the probe's maximum scan depth. Reducing the field of view displays greater detail for the visible area.

ZOOM – The ZOOM key displays a yellow rectangle, which you can position using the trackball from an active scan, frozen image, or a recalled image. Pressing Select zooms the selected region to full screen. To exit zoom, press the ZOOM key again.

CALIPER – Pressing the CALIPER key automatically enters the measurement area menu during an active scan.

DISP. (display) – Pressing the DISPLAY key cycles the on-screen grid through the following three states:

NONE – No grid lines display

TICKS – Ruler style tick marks display along the top and left edges of the image area.

FULL – A full grid displays allowing for visual area estimation without drawing a bounding region.

FILE – Pressing the FILE key opens the File Menu screen.

Using the trackball or arrow keys, selects a file to preview. Pressing Select allows you to recall or delete the selected image, or cancel and return to the file menu.

GAIN – Pressing the GAIN key from an active scan opens the gain settings slider controls. Additional information on the GAIN key and manipulating images is covered later in the manual. In any text entry fields, pressing GAIN displays the on-screen keyboard. This allows access to both upper and lower case characters, along with numerals and special characters.

NEAR – Pressing the NEAR key opens the gain setting controls with the near field slider activated. To increase/decrease the near field settings, use the left/right arrows.

FAR – Pressing the FAR key opens the GAIN settings controls with the far field slider activated.

SELECT – The SELECT key has generic functionality depending on menus and functions on the screen.

FREEZE - Press the FREEZE key to freeze and unfreeze the active image on the screen.

MODE – Press the MODE key to toggle between B mode and B+M mode. Also, used as the sixth function key which corresponds to the action of the blue on-screen menu item.

Dvd's For Studying

Bovine Reproductive Ultrasonography, and Bovine Fetal Sexing Unedited, by BioTech Productions and put together Brad Stroud, DVM.

RESULTS AND DISCUSSION

SOP For Cal Poly Dairy



Figure 13. Students being shown how to ultrasound.

The three stages of competence and uses for the ultrasound.

Stage 1

For a first time user they should have completed a reproductive physiology and artificial insemination (A.I.) class. They need to read all material provided with the ultrasound, watch the two DVD's, and the Power Point presentation provided later in this project. Users then need to watch and go along with a trained herdsman to watch what to do and observe live views from being in the cows. Once they have watched 15 or more views they can then go into cows with the herdsman check there diagnosis to make sure they are consistent as compared to the herdsman's diagnosis.

Stage 2

Once the user is deemed proficient they can then use the ultrasound in diagnosis of calling cows pregnant or open. Student users should not be allowed not able to make the decision to put cows on any synronization (sync) program until they can diagnosis ovaries structures, as explained in the above literature review, students must be able to diagnosis 30 correct structures on cows.

Stage 3

When user is proficient in diagnosing ovaries they can then put cows on a sync program depending on what the structures are on the ovaries.

1. A cow with a Corpus Luteum (CL) = give Prostaglandin and 3 days later Gonadotropin-releasing hormone (GnRH), and breed.

2. A cow with a Follicle= GnRH if no heat 7 days later Prostaglandin 3 days later GnRH and breed
3. A cow with a follicular or luteal Cyst = give GnRH and put in a Cider, 7 days later pull cider and give Prostaglandin, then 3 days later GnRH and breed.

Also in Stage three the user can use the ultrasound in evaluating the ovaries in cows that are going to be flushed and potential embryo recipients to see how affective the treatments worked in stimulating the ovaries, and in placement of the embryo in the proper horn of the uterus with a CL to insure fetal viability.

Power Point for Teaching

To be added at the end of Results and Discussion see page 19. Some of the slides are video clips and in the process of transferring over to word just the first image is on this project.

Training Guide For Bovine Ultrasounding

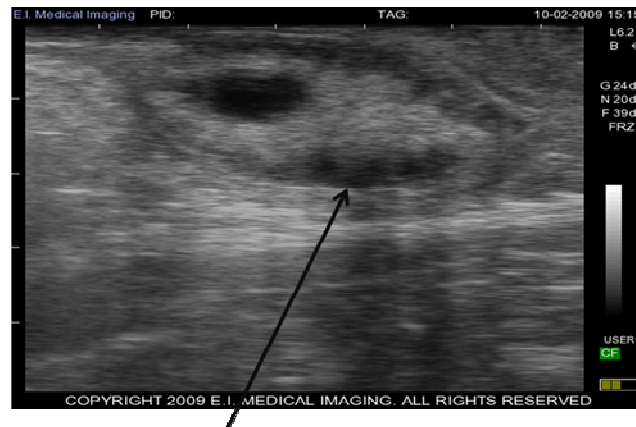


Figure 14. Beginning of Power Point(3).

Ovary Structures

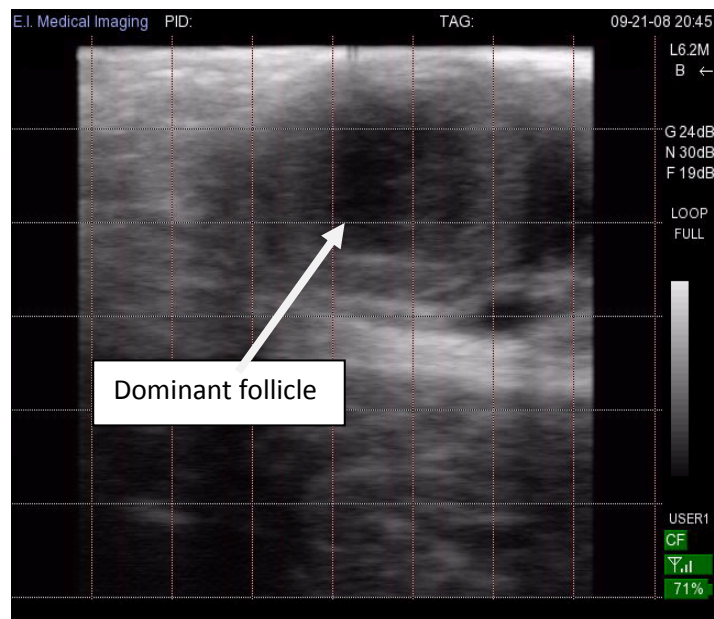


Figure 15. An ovary of a mature cow.



Corpus Luteum

Figure16. Pointing to a corpus luteum.



Follicle

Figure 17. Follicle on a mature cow.

Cystic Ovary

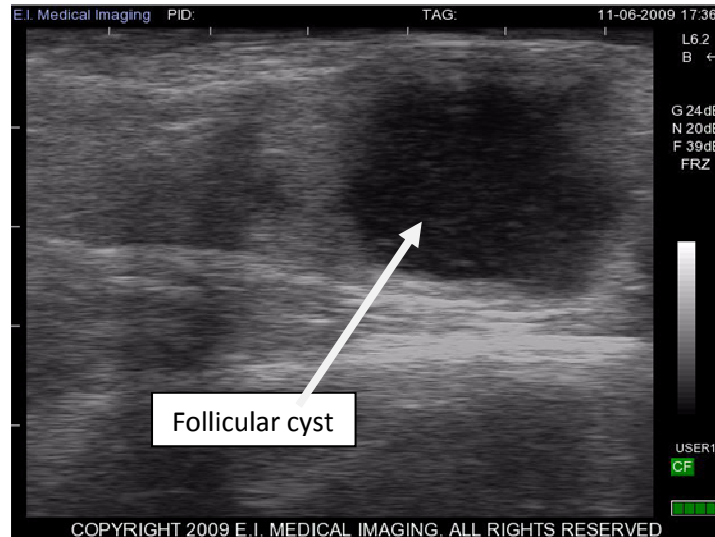


Figure 18. Cystic ovary on a Holstein heifer.

36 Day Fetus



Figure 19. A Viable 36 day Jersey fetus.

36 Day Calf



Figure 20. Another 36 day fetus.

46 Day Fetus

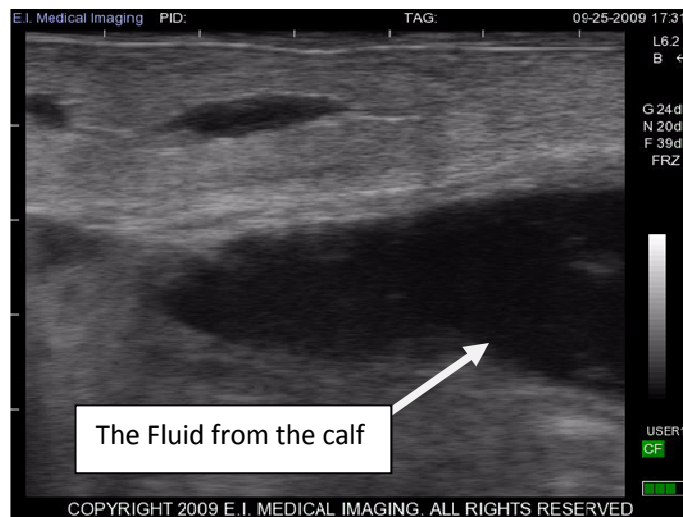


Figure 21. Fluid from a 46 day fetus(video).

75 Day Fetus



Figure 22. A 75 day Jersey calf.

Fetus Heart Beat on 36 Day



Figure 23. The heartbeat of a 36 day fetus.

Non Viable Fetus

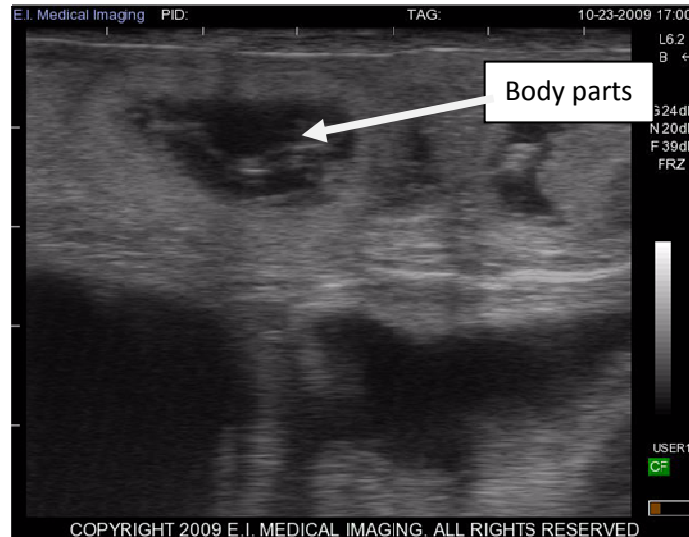


Figure 24. The body parts for a non viable fetus in a heifer.

Twins

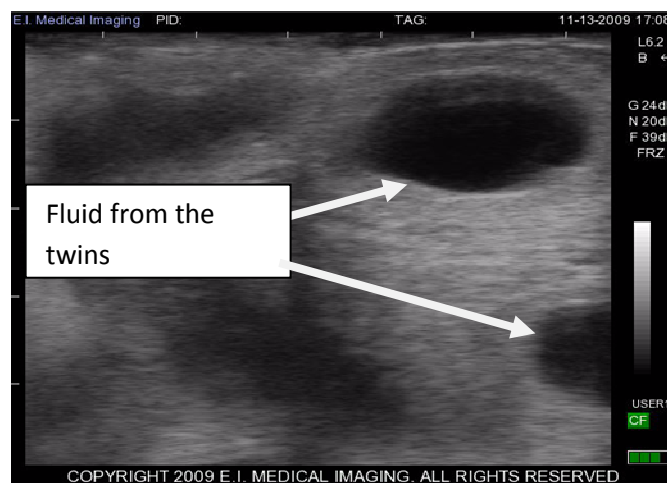


Figure 25. The twins fluid in the two horns(video).

Fetal Sexing Male

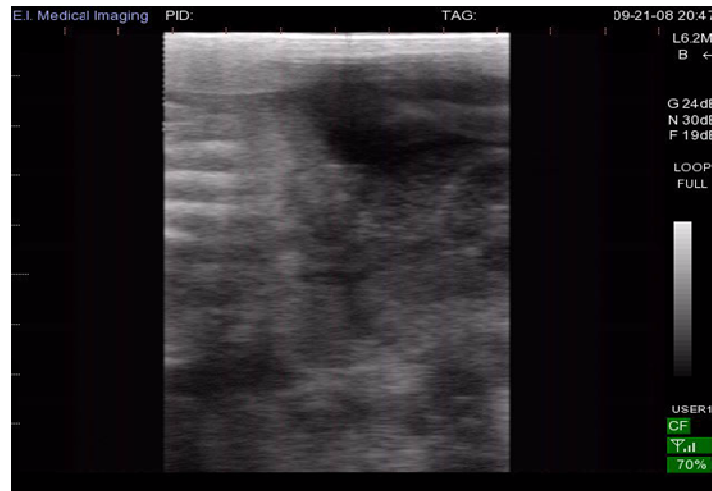


Figure 26. A 96 day male calf(video, 3).

Male

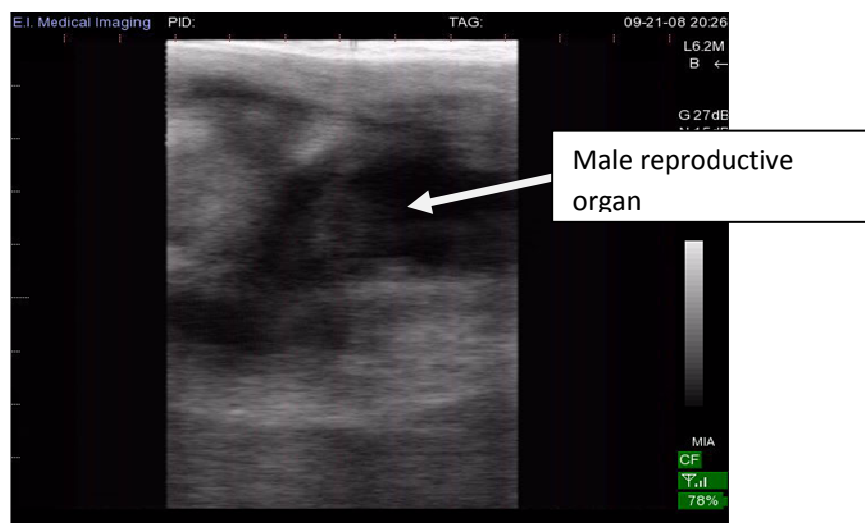


Figure 27. A 80 day male calf(video,3).

CONCLUSION

This project suggests some guidelines to be considered and used in the reproduction protocol in the Cal Poly Dairy. The ultrasound will also give an opportunity for students to get experience in using new technology that they may be using in the future of the dairy industry. This will give Cal Poly students a knowledge and practical skill when they go into job market.

The SOP's that were given are a base line to be considered by the herd manager and the veterinarian so as to most effectively teach new students and become proficient. A cow with a Corpus Luteum (CL) will receive Prostaglandin and 3 days later Gonadotropin-releasing hormone (GnRH), and breed. A cow with a Follicle will receive GnRH if no heat 7 days later Prostaglandin 3 days later GnRH and breed. A cow with a follicular or luteal Cyst will receive GnRH and put in a Cider, 7 days later pull cider and give Prostaglandin, then 3 days later GnRH and breed. Also, the ultrasound can be used to tell the response a cow gets from super stimulation for flushing.

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