

A Practice Approach To The Infertile Cow

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While infertility may be due to a number of diseases which may affect several cows in the herd or to traceable management errors, the following discussion will focus on the infertile cow which:

1. has had a minimum of three infertile services
2. has normal estrous cycles with normal intervals between services
3. is free from gross genital abnormalities detectable by rectal palpation
4. is free from abnormal discharges from the genital tract
5. has had a minimum of one calving to exclude congenital anomalies preventing conception
6. is no older than 10 years, to exclude infertility resulting from senility

These are the criteria for the clinically normal infertile cows as defined by Tanabe and Cassida in 1949.¹ One or more of such cows occur in virtually each herd. When infertility affects valuable breeding animals or good producers, the owner or his herdsman will continue to present them for examination and evaluation. It should be noted that the cow with cystic follicular degeneration does not fit the above criteria, hence will not be discussed.

Normal Incidence

In a group of 100 cows 60% will become pregnant after first insemination. If after a second and third insemination again 60% of the remaining cows conceive, the percentages of total animals pregnant will be 84% and 94% respectively.² However, these percentages are too high because the conception rate decreases as the number of services increases due to a group of animals with chronic abnormalities. As the number of cows to be inseminated decreases this group places an increasing amount of weight in the balance. In actuality, 10-15% of the cows will still be open after the third insemination. Conversely, 10-15% of a cattle population requires 4 or more inseminations.

Etiology

The following causes may play a role in the infertile cow:

1. embryonic death

2. anatomical defects

Congenital defects include:

- a. segmental aplasia, e.g. stenosis of the cervix, persistent hymen, absence of a portion of or even an entire uterine horn (uterus unicornis) or hypoplasia of the oviducts.
- b. complete or incomplete double cervix
- c. partial hypoplasia of the ovaries

Acquired defects include:

- a. pneumovagina or urovagina
- b. adhesions of the cervix, uterus, ovaries, oviducts
- c. hydrosalpinx or pyosalpinx
- d. tumors

3. endometritis
4. delayed ovulation
5. insemination at the wrong time
6. semen quality

It should always be remembered that more than one of these causes may occur simultaneously.

Diagnosis

The history is extremely important in arriving at a diagnosis and an individual breeding (reproductive) record is indispensable.

How old is the animal? Heifers may show congenital anomalies (e.g. segmental aplasia). In older cows fertility diminishes after 8-10 years of age.

Were the previous calving and postpartum period normal? Endometritis and acquired anatomical defects can frequently be traced back to calving problems. Retained placenta is generally accompanied by metritis and leads to delayed involution of the uterus.

On what dates was the animal in heat and/or inseminated this year and in the past? The length of the estrous cycle can be determined on the basis of estrus and insemination dates. The cycle length is nearly always normal for the repeat breeder cow. Irregular intervals may indicate poor heat detection, cystic follicular degeneration or embryonic death. Insemination data of previous years may indicate that the cow was a problem in the past suggesting an anatomical defect.

How long does the cow stay in heat on the average and how strong does she show heat? Cows show a tremendous individual variation in the duration and intensity of estrus. Season also plays a role in this regard.³ The repeat breeder syndrome may be due to poor expression of heat (subestrus) or silent heat. Cows with vague signs of estrus are often inseminated at the wrong time. Cows around Days 6-10 of the cycle frequently participate in the activities of cows in heat without standing themselves. The mounting of other cows is then incorrectly interpreted as estrus.

What is the usual time of insemination? The optimal time for insemination is the second half of heat or shortly thereafter. If the insemination is early and ovulation late, or vice versa, the chance of conception is reduced. This also depends on the quality of the semen used. Insemination and slaughter experiments with cows have demonstrated that as an ovum ages it retains the ability to be fertilized for a longer time than the ability to develop into a viable embryo.⁴ These experiments covered a range of ovulation times from 2 to 28 h after the end of estrus and it was shown conclusively that conception rates dropped due to the increased embryo mortality when cows were inseminated later than 6 h after ovulation.

What is the quality of the semen? Some dairymen inseminate certain cows with semen from bulls with a high PD for production characteristics but which show poor semen quality (after freezing). It need be ascertained not only that the semen processor is reputable but that the semen is handled correctly from the time it leaves the processor until it is deposited in the cow.

What percentage of the herd fails to conceive? If the percentage is relatively high it is likely that we are dealing with a herd problem due to faulty management such as poor heat detection or inadequate nutrition.⁵ It is a significant fact that herd size and infertility or the incidence of repeat breeding are directly proportional.^{6,7}

Clinical Examination

A complete clinical examination of the entire genital tract is an absolute necessity to arrive at a diagnosis and possible treatment. The examination should consist of an external inspection, a rectal examination and a vaginoscopic examination. The examination may be done on any day of the cycle. It is helpful to examine the cow on the day after insemination (Day 2) to determine whether the heat detection was accurate, the insemination done at the right time and whether ovulation took place.

At the time of the *external inspection*, possible scars of cesarean sections or other surgical procedures should be noted. If present, the possibility of abdominal adhesions should be entertained which may explain the failure to conceive. Next, the hindquarters are inspected as well as the under-side of the tail. Discharges may be noted. A dried, white or yellow secretion may indicate a vaginitis, cervicitis or an endometritis. Postestrous hemorrhage may occur on

Day 2 and may indicate whether or not the cow was inseminated at the right time.

The vulva is examined for proper tone and apposition of the labia. Insufficiency in this area may lead to pneumovagina or urovagina (urine pooling). Occasionally a cloaca, a third-degree perineal laceration, is encountered.

The *rectal examination* must be done very carefully to avoid overlooking minor deviations. It is recommended that one cut off the distal 90% of the fingers of a plastic glove and wear a surgical glove over the remaining portion of the sleeve. This permits maximal tactile sensation of detailed structure, and is less traumatic to the rectal mucosa during prolonged exploration than the unaltered plastic glove with its wrinkled fingers and sharp seams.

The perivaginal region is palpated first. Pneumovagina, abscesses, tumors or perivaginal trauma as a result of dystocia, are detected at this time. Tumors must not be confused with old perivaginal abscesses or perivaginal fat which prolapsed via a rupture in the vaginal mucosa. This occurs frequently during the delivery of a large calf, particularly in heifers.

After the vagina the cervix is judged. The average diameter is 35mm and preferably should not exceed 40mm. The cervix should be freely movable. In animals with a cervicitis the cervix is usually large and the external os greater than the anterior portion of the cervix. The cervix tends to become larger with increasing parity. Next, the cervix is retracted posteriorly. Observe the vulva at this time for discharges. If there is pooling of urine in the vagina, a wave of urine will gush from the vulva.

Tumors of the cervix are extremely rare. A double cervix may be encountered. Usually this involves incomplete duplication of the external os only which need not influence fertility adversely. A true double cervix does influence fertility as each cervical canal joins an individual uterine horn. At the time of insemination the horn ipsilateral to the follicle, or both horns should be inseminated. This must be noted on the individual cow card.

The uterus, which is examined next, should be fully retractable into the pelvic cavity. Acquired anatomical defects such as adhesions, are noted at this time. They may be the sequela to abdominal surgery, peritonitis, a severe metritis or trauma during parturition. Occasionally trauma is inflicted during infusion or insemination which may result in a "pipet abscess" or adhesions.

Abnormal conditions of the uterus can only be detected if the uterus is fully retracted and if both horns are examined over their entire length. congenital anomalies such as uterus unicornis can be determined fairly easily. Mucometra occurs primarily in heifers and must not be confused with a gravid uterus.

Tumors of the uterus are uncommon. Occasionally, lymphosarcoma of the uterus is encountered and is manifested by multiple firm, smooth spherical masses in the uterine wall. The onset and development may be quite rapid.

The diameter of each of the uterine horns, just anterior to

the bifurcation, is estimated. The diameter of the fully involuted uterine horn (45 days postpartum) ranges from 25-35mm. The difference between the horns should not exceed 5-10mm. Asymmetry and thickening of the wall suggest inflammation. However, *endometritis* is difficult to diagnose by rectal examination alone.

While examination of the ovarian bursae is generally not done during the routine postpartum examination, it must be included in the evaluation of the infertile cow. The ovary may be completely surrounded by and adhered to the bursae. The adhesions may be due to inflammation or trauma. Infections either ascended from the uterus (e.g. after injudicious use of estrogens in the treatment of pyometra) or they may be the result of local peritonitis. Adhesions may also follow enucleation of the corpus luteum. If the adhesions are minor and/or unilateral the cow is subfertile; if severe adhesions occur bilaterally the animal is sterile. If the bursae are free, permitting the insertion of 2-3 fingers, the oviducts may be examined. An extensive hydrosalpinx or pyosalpinx is relatively easy to diagnose. Subtle deviations are only found on post mortem examination. Normally, the oviduct can barely be palpated. If the oviduct can be distinctly felt it may be considered abnormal. Hydrosalpinx may be confused with an ovary containing follicular cysts. Careful examination will reveal the ovary itself in such cases.

Ovarian tumors, in addition to being rare, usually lead to irregularities of the estrous cycle and as such fall beyond the scope of this discussion.

Delayed ovulation is difficult to diagnose in the field and is usually an accidental finding. Many cows which allegedly ovulate late are in fact inseminated too early. In a careful study of repeat breeder cows delayed ovulation occurred only twice in 116 estrous cycles. Two cows were involved; one ovulated 24 h and the other 48 h after the end of estrus. Both cows ovulated at the normal time (8 and 12 h respectively) after the subsequent estrus without treatment.⁸

A *vaginal examination* should follow the detailed rectal examination of each problem cow. Particular attention is paid to the secretions. Clear mucus occurs at estrus and should correlate with uterine tone and follicular activity. If the secretion is cloudy or mucopurulent, it may be the result of endometritis especially if the secretion comes directly from the external cervical os. Abnormal secretions may also be the result of a vaginitis, or a purulent discharge may come from a recently ruptured perivaginal abscess. A slightly cloudy mucous discharge is frequently seen in cows with cystic follicles. This is not due to endometritis and may be disregarded. Vaginitis generally does not affect fertility. A speculum examination further aids in the diagnosis of pneumovagina or urovagina. With a pneumovagina no air can be heard to rush in when the speculum is introduced. With a urovagina, urine is pooling on the vaginal floor. The latter may be an incidental finding which is absent upon repeated examinations. A chronic urovagina is characterized by vaginitis while the cervix has dropped over

the pubic brim whereby the external os feels enlarged upon palpation per rectum.

Vaginoscopic examination also permits the diagnosis of certain congenital anomalies. A double cervix is readily detected provided the speculum is not inserted too far. Persistent mesonephric duct cysts. (Gartners ducts) and vestibular gland cysts are also easily identified. Neither are associated with infertility. The patency of the cervix may be checked with the aid of a fine (16 ga) metal catheter.

In many cases upon completion of the detailed clinical examination, no abnormalities will have been found. The findings of deviations is related to the order number of the insemination. Considerably fewer abnormalities will be detected in cows at the time of the second insemination than at the eighth insemination. Small defects may only be found at slaughter. In some cows, even then, no defects will be found. Perhaps the uterine milieu of the cow was aberrant or asynchronous in such cases.

One of the most important reasons for failure of a cow to become pregnant is the occurrence of embryonic death. Possibly this involves abnormal embryos which are eliminated in this manner. Each fertilization may be regarded as a genetic experiment and it is inevitable that a number of these experiments fail. Should failure occur sequentially in the same cow, she is considered a problem breeder. However, she has the same chance as the next cow that the genetic experiment will be successful at the next insemination. Embryonic death may be regarded as a normal way of eliminating unfit genotypes at a low biological cost.⁹

Prognosis

It is important for the owner to know whether to continue inseminating a cow or to stop breeding her and cull her when her milk production drops.

The prognosis depends entirely on the severity of the abnormality found. Conditions such as a double cervix, adhesions of the uterus, delayed ovulation, poor semen quality, and untimely insemination have a favorable prognosis. Chronic urovagina, ovarian adhesions, hydrosalpinx and stenosis of the cervix have a poor prognosis.

Treatment

- 1. No therapy is indicated if early embryonic death is suspected.** There is no rationale for the injection of any hormone preparations. If one suspects a subclinical endometritis, flushing of the uterus may have merit. Each horn should be flushed individually with 500-1000ml of sterile saline to which penicillin may be added. A 2-way Foley catheter (18-20 French gauge) may be used. The sterile catheter is aseptically introduced into each horn with the aid of a stylet (e.g. the plunger of an AI-gun). Next the

balloon is inflated with 15ml of air and the stylet is withdrawn. 75-100ml of flushing medium are used to distend the horn and are then allowed to escape. The procedure is repeated 4-5 times for each horn. During embryo transfer procedures it has been shown that the flushing medium returns cloudy from the uterus in cases of sub-clinical endometritis.^{10, 11} Fertilization generally does take place in these cases but early embryonic death occurs when the embryo comes in contact with the inflamed endometrium. An excellent recent review of embryonic mortality in cattle was made by Ayalon.¹²

2. There is no treatment for cows with *anatomical defects* with the exception of pneumovagina and urovagina if the latter are due to lack of closure of the vulva. These cows generally benefit from a Caslick operation. If urine pooling has been present for some time additional intra-uterine treatment with antibiotics is advisable. If the pneumovagina or urovagina are due to sagging of the vaginal tissues in conjunction with a horizontal orientation of the vulvar lips, surgery is of little benefit. In these cases the vagina should be mopped dry with several wads of cotton prior to artificial insemination. This prevents contact of the semen with the urine and, provided the endometrium is not affected, the possibility for conception exists. Insemination should be intra-uterine. Natural service is contraindicated in these cases.

Cows with a true double cervix must be inseminated on both sides or via the cervix ipsilateral to the largest follicle. Alternatively, the cow may be serviced by the bull.

3. Intra-uterine antibiotic therapy is indicated when *chronic endometritis* is diagnosed or when sub-clinical endometritis is suspected. It is believed that bacteria have deeply invaded the endometrium in these cows with the result that a single intra-uterine infusion on the day after insemination is of little value. It is recommended that the uterus be infused with 1 million units of crystallin penicillin in 20ml of physiological saline solution daily for 3-5 days. If done in conjunction with insemination, the first infusion should be done as soon as estrus is noted, the second 1 to 2 h after AI and the third 24 h after AI. Uterine infections are not a major contributing factor to infertility in cattle.^{13, 14}
4. Since *delayed ovulation* seldom occurs in the cow no treatment is indicated. If treatment is nevertheless desired, 100mcg GnRH or 3000 units HCG IV may be given at the onset of the next estrus.
5. If *timing of insemination* is difficult for individual cows, the animal may be inseminated twice with an 8 h interval during the same estrus. Alternately the cow may be bred by natural service. If insemination of cows during the wrong part of the cycle is suspected on a farm, milk progesterone concentrations may be

monitored in samples of after-milk taken at the time of insemination. Progesterone levels should be less than 1ng/ml. This procedure constitutes an excellent check on the efficiency of heat detection in a herd.

6. If *heat detection* is questionable for the individual animal with a palpably normal genital tract, ovulation may be managed, and timed insemination be performed. 25mg prostaglandin-F (or 500mcg of a synthetic analog) are given intramuscularly during the luteal phase (or when a large palpable CL is present, Day 5-18 of the estrous cycle) and the animal is inseminated when she is in estrus or at 80 h after injection. This approach saves time, which will offset the expense of the drug in most instances, but has the inherent danger of becoming a substitute or a crutch for proper heat detection.
7. The *quality of the semen* used should be monitored. Only semen from bulls with high fertility should be used in cows with questionable fertility. A breeding soundness examination should be done on all bulls used for natural service. Libido, frequency of service and bull-to-cow ratio should be monitored regularly. Natural service does result in a higher conception rate with a difference of not more than 9% in favor of natural service.¹⁵ Natural service should not be resorted to too quickly if heifer calves are raised as replacements.
8. *Older cows* should be inseminated with a double inseminating dose. The uterus in these cows frequently is large and pendulous.
9. It is possible that *blockage of the oviducts* is present in cows which have a palpably normal genital tract. Patency of the oviducts may be verified with the intra-uterine-infusion of 40ml phenolsulfonphthalein (PSP) solution. In normal cows PSP dye is present in the urine within 30 minutes. In cases of bilateral occlusion dye is not evident in the urine two hours later. In two animals with unilateral blockage dye appeared at an intermediate time between the normal and bilaterally occluded cases.¹⁶ The bladder should be emptied prior to the onset of the test.

Conclusion

Many of the causes of failure of cows to conceive may be prevented by the proper selection of sires, supervision and hygiene at the time of calving and a regular herd reproductive health program. The most important aspect of such a program is the postpartum examination of all cows 30 days after calving. Many of the above described conditions may be diagnosed at this early time and, if indicated, treated. It is further advisable to routinely examine all cows which have been inseminated more than three times unless problems are noted earlier by the herdsman or the inseminator.

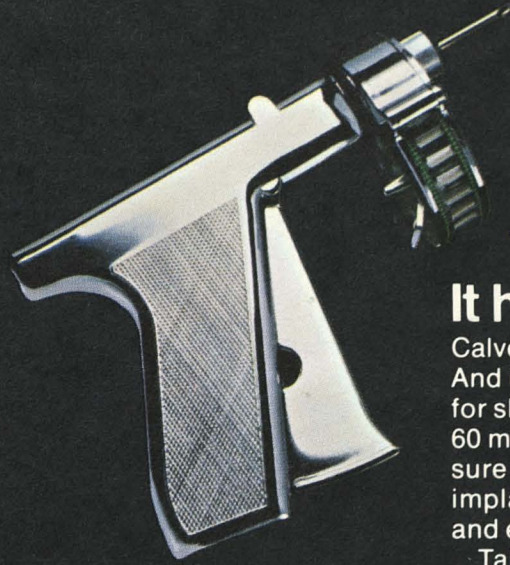
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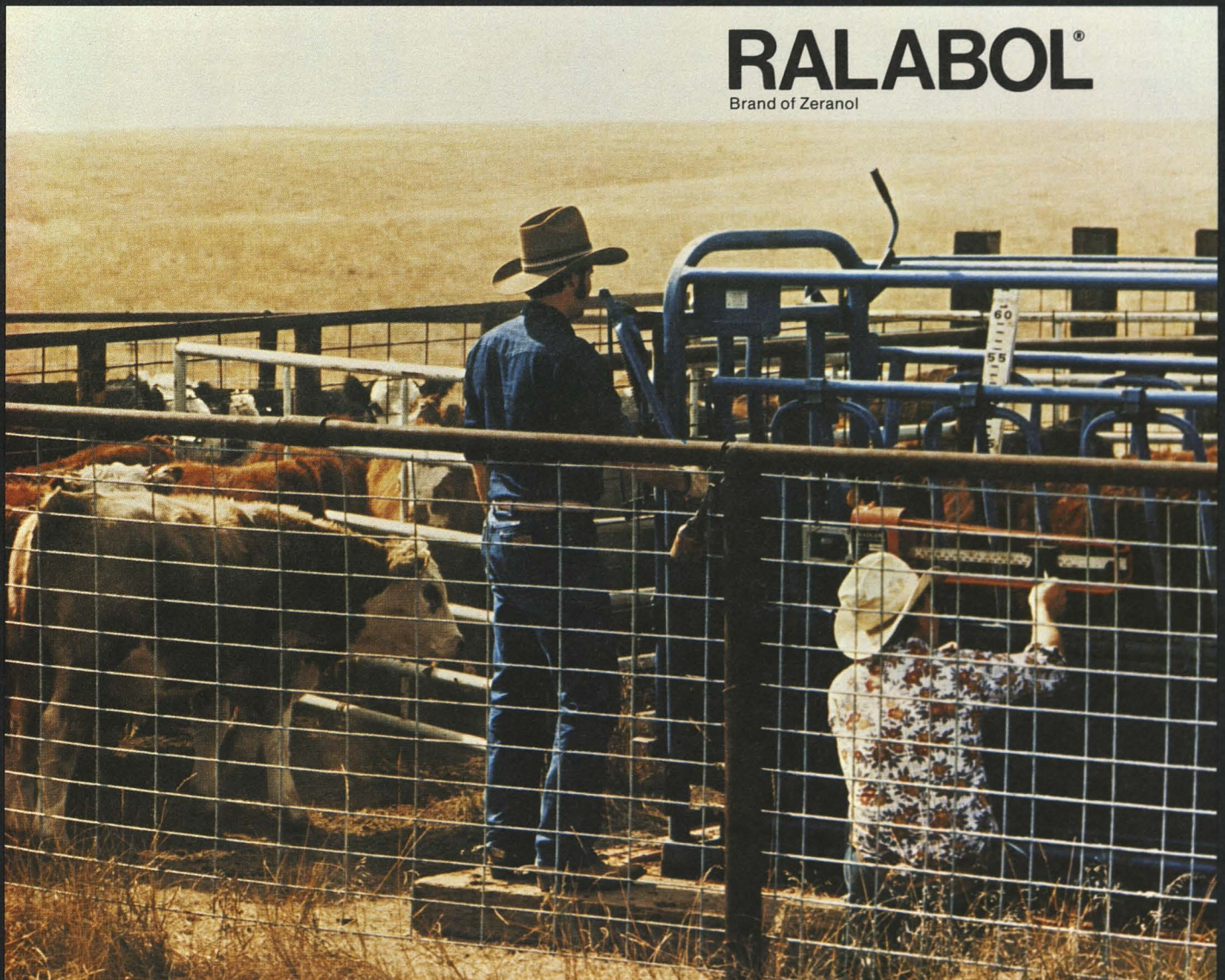
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