



Pregnancy Loss in the Alpaca

*Losses arising from abortion are distressing for owner and animal alike and are a financial set back. Well planned breeding programmes can be severely disrupted with knock-on effects for the genetic development of herds and breeders marketing initiatives. **Ahmed Tibary**, DMV, PhD, Dipl. ACT, of the Veterinary Teaching Hospital, College of Veterinary Medicine, Washington State University, outlines some of the causes and consequences associated with this problem.*

[Please refer to the original magazine article (Alpaca World Magazine Spring 2005) for the accompanying diagrams, ultrasound scans and photographs]

Pregnancy loss is the second most common complaint in alpaca infertility in my practice. There is no epidemiological data on the extent of this problem. However based on records in the theriogenology service at the Veterinary Teaching Hospital, Washington State University, 7 to 12% of all pregnancies will be lost during the 11 to 12 month gestational course. From a clinical point of view, pregnancy losses can be divided into 3 categories 1) early embryonic death; 2) early fetal loss and 3) late fetal losses. Diagnosis of the cause of pregnancy loss is one of the most challenging aspects of infertility work up. It requires the services of a veterinarian with a good background in theriogenology (veterinary speciality dealing with infertility, obstetrics and neonatal problems), and an excellent diagnostic laboratory support. The objective of the present article is to discuss the causes, diagnostic approach and possible therapy for pregnancy loss in alpacas.

Defining the problem: Importance of pregnancy diagnosis

When discussing or working up a case of pregnancy loss it is important to define the precise problem in terms of whether this is an individual female problem or a herd problem, when does the loss occur and what are the historical data of importance that happened before observation of the pregnancy loss. Talking about pregnancy loss suggests that a female has been diagnosed pregnant at a first examination and is found open at a subsequent examination. Therefore, of utmost importance in defining the problem is what method is used to diagnose pregnancy in the first place.

Pregnancy can be diagnosed by a variety of methods and is most commonly based on female behavior, hormone assays and ultrasonographic examination of the uterus and its content.

I consider ultrasonography to be the gold standard method for any examination for pregnancy. For a well-trained person, ultrasonography carries a very high accuracy (100%) starting at 12 days post-breeding (Figure 1) when done trans-rectally and starting at 45 days (Figure 2) and up to 5 months when done trans-abdominally (Figure 3). Transabdominal ultrasonography for pregnancy evaluation beyond 5 months is possible and highly accurate but requires shaving a large area of the abdominal wall to allow better visualization because the fetus is very deep in the abdomen. Ultrasonography offers the veterinarian the clinical means not only to establish a diagnosis of pregnancy but also evaluate normalcy of the pregnancy with respect of cervical tone, placental health, fetal well-being and fetal number (twins). Placental health is generally appreciated by looking at the attachment between the maternal side (uterine lining) and the fetal

side (fetal membrane; placenta, chorioallantoic). Fetal well being is determined by its growth in relation to gestation stage (using formulas correlating body measurements with age in days) as well as its activity (movements) and its heart rate and rhythm. In addition the appearance of fetal fluid on ultrasound can be used to detect changes that may result in loss of a pregnancy.

Although very highly suggestive of pregnancy, specific behaviour towards the male (spitting-off) is only about 85% accurate in terms of determining pregnancy status. Many females may reject the male for other reasons and most commonly because they have high progesterone that may be due to presence of luteal structures (tissue that produces progesterone, luteinized follicles or corpus luteum) without a real pregnancy. Therefore, although spitting-off behavior is a good screening method for pregnancy diagnosis it remains important to confirm the status of pregnancy by the gold standard method "ultrasonography".

The most common hormonal assay that is used for determination of pregnancy status is progesterone. Scientific studies have shown that in order for a female to maintain pregnancy the hormone progesterone which is secreted by the corpus luteum (CL) (Figure 4) should remain high. The corpus luteum will be the sole source of this hormone and therefore any disruption of its activity may result in loss of pregnancy. But how high is high when progesterone is considered for pregnancy diagnosis? Most labs suggest that pregnancy is only guaranteed if the level of serum progesterone is at or above 2 ng/ml. Others prefer to use a cutoff of 1.5ng/ml. Our ongoing research suggests that there are several sources of variation concerning progesterone levels in pregnant alpacas and it is not rare in our practice to see pregnant alpacas with values between 0.9 and 1.5 ng/ml. Where do these variations come from? Certainly some are due to sample handling errors, lab errors, but of most importance to us are other factors intrinsic to the female itself. In addition to these variations that make progesterone use for pregnancy diagnosis not reliable there is an added factor which is the presence of progesterone in non-pregnant females with persistent luteal structures on the ovaries (persistent CL or luteinized follicles). In fact presence of significant levels of progesterone in the blood should be considered only as a first step in pregnancy diagnosis and the status should be confirmed by ultrasonography.

There are other hormones (estrone sulfate, relaxin) that are used in the later part of gestation to evaluate the fetus and pregnancy however these are rarely used in common practice.

Diagnosis of Pregnancy losses in alpacas

As stated above, determining that there was indeed a pregnancy loss will primarily be based on establishing with certainty that the female was pregnant and is now open or by actually visualizing symptoms that are suggestive of a pregnancy loss in progress.

In many instances pregnancy loss diagnosis is posed when a female that has been diagnosed as pregnant (preferably with ultrasound) fails to develop normal third trimester signs of advanced pregnancy (increased abdominal size; visualization of fetal movement) or even worse she may fail to deliver well past her anticipated due date. In some instances, the presumption that the pregnancy was lost is based on behavioural signs of receptivity to the male after establishment of pregnancy (sitting next a breeding pair or across from a male fence).

The best evidence of pregnancy loss is the presence of abnormal discharge from the vagina or elimination of the fetus and the fetal membranes. Vaginal discharges are generally obvious if the loss occurs after 60 days. Most pregnancy losses before this date are seldom seen because some females will just reabsorb or even if they eliminate the fetus and its fluid and the signs will go unnoticed because of the smallness of the conceptus. In cases of suspicion of recent loss an inspection of the dung pile may reveal the presence of fetal remnants. The opposite is also possible, owners notice fetal or placental parts on the field, which suggests that a female has lost her pregnancy. In this particular case an inspection of the entire group of females in that pen is warranted.

Pregnancy loss may sometimes be suspected during the process of pregnancy diagnosis. On occasion during pregnancy examination, evidence of disrupted fetal membrane (Figure 5), fetal heart rate, or abnormal ultrasound appearance of uterine content may suggest a non-viable pregnancy.

Causes of pregnancy losses in alpacas

Just like any other species, causes of pregnancy loss in alpacas are numerous (Table 1). Pregnancy loss can generally be categorized as sporadic (happening every once in a while and concern only a few females without real association) or epidemic (storm, several females losing pregnancy within a short interval of time). Sporadic pregnancy losses are generally due to factors within the individual itself. An example of sporadic pregnancy loss is the female that mistakenly receive a drug that causes loss of corpus luteum function (Table 1), or has undergone a stressful situation resulting in her losing the pregnancy (i.e. severe disease process, long stressful trip, heat stress). Probably the most common sporadic form of pregnancy loss is illustrated by females that tend to become pregnant relatively easily and then lose the pregnancy within a few weeks or cannot carry the pregnancy to term due to placental insufficiency, hormonal imbalances or genetic predisposition. Placental insufficiency is due to a lack of normal placental development resulting from the presence of scarred uterine tissue or premature placental separation. Hormonal imbalances may be brought about by stressful conditions. Progesterone deficiency is suspected in many females but is hard to isolate as a primary cause of pregnancy loss.

Infectious causes of pregnancy losses are of special interest to large herds or herds that have no biosecurity measures. The most commonly diagnosed infectious causes of pregnancy losses are leptospirosis, chlamydiosis, and toxoplasmosis. These diseases may cause severe losses if they happen in an epidemic fashion.

Table 1: Causes of pregnancy loss in alpacas

Category	Cause	Most likely group
Sporadic pregnancy losses	Severe systemic diseases	All
	Severe nutritional deficiencies	Lactating females Young maiden females
	“Stress”, heat stress	All groups; may be epidemic if several females are involved
	Progesterone insufficiency	Some females
	Selenium deficiency	All
	Vitamin A	Young females
	Iodine deficiency	Young females
	Placental insufficiency	Older females or females with history of uterine infection
	Cervical incompetence	Females with history of dystocia
Metabolic problems (hepatic lipidosis)	Obese females	
Sporadic drug induced	Prostaglandin injections	All, any stage of pregnancy
	Corticosteroids	All, later part of pregnancy
	8 way vaccines	Some females may react to this
Infectious pregnancy losses	Chlamydiosis	May cause abortion storms
	Toxoplasmosis	May cause abortion storms
	Leptospirosis	May cause abortion storms
	Brucellosis	Not present in the USA
	Bacterial placentitis	Females with bad vulvar conformation or recurrent vaginal prolapse during pregnancy
Genetics	Twinning	Some females
	Severe fetal malformations	Rare
	Fibre production	High producing fine fibre animals

Approach to diagnosis of the cause pregnancy losses in alpaca

Diagnosis of the exact cause of pregnancy loss is generally very frustrating and requires investment in time and cost of laboratory procedures. The best chance of determining the cause of pregnancy loss in the case of an observed abortion or stillbirth is to provide immediately the veterinarian with all the tissues for laboratory submission. These should include the fetus and placenta (Figure 6). These tissues should be removed and secured in plastic bags and rushed to a veterinarian in a fresh condition or cooled (not frozen). In addition, the veterinarian may opt to take uterine culture and blood samples from the aborting female(s). Obtaining these samples in good condition within the first 24 to 72 hours after abortion greatly improves the diagnosis of the cause of pregnancy loss. In some cases the veterinarian may suggest taking blood samples from other females in the herd for comparison purposes. **ALWAYS TAKE ABORTION SERIOUSLY BECAUSE IT COULD BE JUST THE BEGINNING OF AN ABORTION STORM.**

The placenta is a mirror image of the uterine lining and should be kept fresh for evaluation by a veterinarian (Figure 7). The placenta will be examined by the veterinarian for any signs of inflammation (placentitis) or infection that may be involved in the abortion or still birth (Figure 8). The surface of the placenta will also provide information on possible area of scarring (fibrosis) which will lack the typical arrangement of tissue (villousities of the microcotyledons) responsible for the transfer of nutrient between the dam and the fetus. Samples from the placenta will be taken for microscopic evaluation (histopathology).

The fetus is usually examined for malformations, growth retardation or evidence of infectious agents. Growth retardation is determined by measurement of the size of the fetus and comparing

it to normal growth charts. Samples will be taken from the stomach of the fetus will be taken for bacteriological examination.

The female(s) experiencing pregnancy loss at any stage of pregnancy should be isolated from the rest of the herd and examined thoroughly. The initial examination generally focuses on detection of any systemic diseases or nutritional problems that may be a responsible for or a contributing factor to pregnancy loss. Females in poor body condition or suffering from mineral deficiencies experience a higher rate of pregnancy attrition, abortion and stillbirth. Young females that are bred before they have reached at least 65% of the expected adult weight and size will experience a higher rate of abortion or early pregnancy loss. Data from South America showed that females that are bred before they reach 90 lbs in weight experience pregnancy loss at a rate of 40 to 60%. In North America, because of a higher level of care and nutrition young females may reach and surpass this weight before they are sufficiently developed (uterus and bone structure) to be able to maintain a pregnancy.

Progesterone insufficiency is without doubt the most commonly “diagnosed” and “treated” disorder by several breeders and veterinarians. What do we know about progesterone deficiency? Although this is a likely cause of pregnancy loss in alpacas, it is very hard to determine whether progesterone decline is a result of embryonic death or that the embryo dies because of lack of progesterone. Many articles stipulate that the minimum level of progesterone in blood required for maintenance of pregnancy is 2 ng/ml. However, results in an experiment in progress in our laboratory shows that many normal pregnant alpacas have progesterone concentration as low as 1.2 ng/ml. Reports from field observations indicate progesterone values as little as 0.6 ng/ml in alpacas that carried to term. These results point to a serious problem in that many alpacas may be supplemented with progesterone when they do not need it and that there may be some errors in reported progesterone values. It is my clinical opinion that progesterone should be >1 ng/ml for a pregnancy to be maintained. Low progesterone values reported in pregnant alpacas may be due to sample handling or to laboratory errors. Other factors affecting progesterone values, due to the individual female, are being investigated currently in our laboratory.

Pregnancy loss may also occur in alpacas due to stressful conditions (heat stress, re-adjustment to a new environment...). These situations generally remain hypothetical and their diagnosis will be based on historical data (was there a change in management or handling in the days preceding pregnancy loss?). Another form of “stress” that I suspect may be cause mid-term to late-term abortion in alpacas is the competition between fibre production and fetal growth.

Treatment with corticosteroids (even topical eye ointment), some eight way vaccines and administration of the drug prostaglandin F2 alpha or its analogues (normally used for treatment of retained CL's) will cause abortion.

Repeated pregnancy loss between 30 days and 8 months due to twins has been reported to me on several females. Double ovulations and twin pregnancies are not rare in alpacas. There seem to be an increase in these twinnings probably because of increased nutritional plan and improvement in our ability to detect the twins by ultrasonography. This is an added benefit of using ultrasound for pregnancy diagnosis rather than just progesterone levels or behavioural manifestations. Late twin abortion will cause excessive time loss and added hardship for the aborting female with increased dystocia and postpartum complications which may jeopardize the future reproductive life of the dam. Therefore early diagnosis of twin ovulations and twins is highly recommended particularly in those females that have had already an incidence of twin pregnancy. Many alpacas that start their pregnancy as twins will reduce to a singleton and will go on to have a normal pregnancy to term. I recommend that any female that has not reduced the number of fetuses on her own by day 35 of pregnancy be aborted at this stage.

Prevention of pregnancy losses in alpacas

Prevention of pregnancy losses in alpacas requires several measures at the herd level and at the individual level.

At the herd level, prevention of outbreaks of losses requires development, with the attending veterinarian, of strict and detailed biosecurity measures as well as a good herd health (proper regular deworming and vaccination) and nutritional (regular evaluation of feed quality, trace mineral levels and body condition of animals) programmes. Vaccination against some of the abortion causing diseases such as Chlamydiosis and leptospirosis may be indicated in high risk situations. Genetic selection programmes may be involved in overall reproductive performance in alpacas and should always be kept in mind.

On an individual level, high risk pregnancies or female at high risk of losing their pregnancy after breeding should be identified early. This group should include any female that has had a history of pregnancy loss, obstetrical problems or uterine infections. All these condition can lead, if not treated properly, to uterine fibrosis (scarring) which will not be compatible with normal placental function and result in early fetal loss or abortion. Uterine biopsy may be indicated in some females in order to determine if they have these chronic changes in the uterus. The best way to prevent pregnancy loss and maximise the reproductive career of a female alpaca is to adopt strict measure in the prevention of uterine infections and birthing problems which are responsible for development of these chronic changes. Uterine infections are best prevented by avoiding repeated unnecessary breeding. If uterine infection occurs they should be promptly and adequately treated. Obstetrical manipulations should be done by a knowledgeable person observing strict hygiene measures.

High risk females should monitored closely during pregnancy. If progesterone supplementation is the option taken, fetal viability and well being should be verified regularly to avoid maintaining a dead fetuses in the uterus. Several types of progestogens (progesterone or progesterone like hormones) are available on the market. Although, anecdotal success with some of these are reported by breeders and veterinarians there has been no scientific research to demonstrate their efficacy in prevention of pregnancy loss nor the manner by which they should be used.

Sexual rest of older female or females with uterine fibrosis for a few months may improve their chances in carrying to term.

In conclusion, pregnancy loss in alpacas is relatively common particularly in populations at high risk (older females, maiden underdeveloped females, females with a history of uterine infection or obstetrical problems). Management measures to reduce the incidence of these problems and “prepare” females for breeding is the first step in prevention of losses. The use of ultrasonography is recommended for early pregnancy diagnosis and monitoring of pregnancy. Abortions can be due to infectious diseases and each should be taken seriously, working with the veterinarian immediately after noticing an abortion. Submitting fetal, placental and dam samples to a laboratory improves the odd of determining the cause.

Acknowledgement

I am indebted to several colleagues as well as breeders from all over the USA and particularly WA, ID, OR, CA, CO and MT, who share with me their clinical observations and entrust me with care for their alpacas.