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A Clinical Study of Infertility in Alpacas in China

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Abstract: The clinical performance, diagnosis and treatment of infertility in alpacas farmed in China's Shanxi province are reported here. Out of the 62 female alpacas studied, 5 (8%) were diagnosed as infertile 6 months after initiation of the breeding season. One infertile alpaca showed sexual receptivity to male but poor follicular development with absence of growth of large follicles to ovulatory stage. Treatment with Follicle Stimulating Hormone (FSH) restored follicular development. Human Chorionic Gonadotropin (hCG) treatment resulted in ovulation and a healthy female cria was born 347 days after mating. Two infertile alpacas exhibited sexual receptivity and presented multiple persistent follicles >12 mm on ovaries for >1 month. Treatment with hCG resulted in disappearance of cystic structures. Prostaglandin F2 alpha was administered 10 and 11 days later to induce corpus luteum regression. Animals were mated upon growth of follicles to >8 mm and offspring born 347 and 351 days post mating. Remaining infertile alpacas were diagnosed with endometritis through clinical evaluation and transrectal ultrasonography. Animals displayed sexual receptivity, strained during urination and had visible vaginal discharge. Treatment consisted of uterine lavage with 0.9% NaCl saline containing penicillin (5000 IU mL^{-1}) and streptomycin (10 mg mL^{-1}). Both females were mated and gave birth following 2 months recovery period.

Key words: Infertility, alpaca, follicle development, cystic follicles, endometritis, ultrasound

INTRODUCTION

Over the past 20 years, there has been an increase in the commercial rearing of alpacas in Australia, New Zealand, Europe and the US for the companion animal industry as well as for the production of high-quality fiber (Brown, 2000). Success in alpaca introduction and production in other parts of the world hinges on reproductive efficiency. The reproduction of alpacas in South America, Australian and the US has been reviewed comprehensively (Sumar, 1996; Tibary and Vaughan, 2006; Vaughan and Tibary, 2006). Conception and birth rates in alpacas vary from 50-90% depending on mating system used, the fertility of the sire, post-partum interval, environmental conditions and nutrition (Vaughan and Tibary, 2006). The common reasons for presenting infertile females for examination were repeat unsuccessful breeding, pregnancy loss, visible abnormalities of the genitalia and continuous rejection of male (Vaughan and Tibary, 2006).

In June 2002, a herd of huacaya alpacas containing 20 mature females and 3 mature males (originating from Australia) was the first to be imported to China. In this report, researchers describe reproductive performance of such animals including clinical cases of infertility observed and diagnosis and treatment utilized for such animals.

MATERIALS AND METHODS

Animals and reproductive examinations: This study was conducted on a herd of huacaya alpacas introduced from Australian with reproductive performance collected from 2006-2010. All animals were maintained on native fenced pastures at the alpaca central farm at Shanxi Agricultural University which is located in Jinzhong city, Shanxi province, China. The region lies in a temperate zone with average annual precipitation of 503.7 mm (range 380-770 mm), average daily temperature of 6.3-10.7°C and mean frost free period of 150 days. During the experiment

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(2006-2010), the reproductive status of 62 mature female alpacas was observed. Five mature females (3-7 years old, weighing 56-82 kg) that failed to conceive for >6 months were selected for diagnosis and treatment. The reproductive organs of all the infertile alpacas were examined by transrectal ultrasonography using a B-mode scanner with a 10 MHz linear-array transducer (HONDA, HS-1500, Japan) and ovaries were scanned daily for >1 month to evaluate follicular development. All examinations were performed by the same operator. Pregnancy diagnosis was performed by ultrasonography 20 days after mating.

Diagnosis and treatment of infertility: Ovarian inactivity was diagnosed when no mature follicles (>6 mm) were found on ovaries for >1 month. Treatment consisted of 200 mg FSH (Folltropin, Bioniche Animal Health Canada Inc., Belleville, Ontario, Canada) i.m. divided >3 days plus a single i.v. dose of 1000 IU of hCG (Folligon, Intervet, Booxmer, Holland) 24 h after the last FSH treatment. The treatment was followed by mating.

Cystic follicles were diagnosed when several large follicles (>12 mm) were found on ovaries present for >1 month and no ovulations were observed after mating with a fertile sire. Treatment consisted of 1000 IU hCG administered intravenously. Disappearance of cystic structures was confirmed via ultrasonography. On day 10 and 11 after hCG a, 200 μg dose of cloprostenol (Cayman Chemical, Ann Arbor, MI, USA) was administered to remove the Corpus Luteum (CL) and growth of ovarian follicles monitored by daily ultrasonography. Animals were subsequently mated upon detection of >8 mm follicle.

Diagnosis of endometritis was confirmed by observation of vaginal discharge, thickening of the uterine wall and the presence of intrauterine fluid. Treatment included daily uterine lavage for 7 days with warm, sterile, isotonic saline containing penicillin (5000 IU mL^{-1}, Shanxi Zhendong Pharmaceutical Co., Ltd. Changzhi, Shanxi, China) and streptomycin (10 mg mL^{-1}, Shanxi Zhendong Pharmaceutical Co., Ltd.). After a 2 months recovery period, follicular growth was monitored by daily ultrasonography and animals mated when a >8 mm follicle was detected.

RESULTS AND DISCUSSION

Overall fertility in alpaca herd in China: Although, alpacas have been introduced to various areas around the world, little information on infertility is available regarding alpacas raised in Asian countries. Typically, the fertility of alpacas varies from 50-90% (Vaughan and Tibary, 2006). In the present study, the fertility of alpacas introduced to China was quite high and only 5 of the 62 alpacas (8%) were infertile. These results indicate that the alpacas were well adapted to the conditions under which they were raised at the central farm at Shanxi Agricultural University which is located in Jinzhong city, Shanxi province, China.

Of the 62 female alpacas observed during the experiment from 2006 through 2010, 5 were infertile. The other 57 were fertile and conceived within the first three mating attempts after puberty or post-partum. The birth rate of the herd of alpacas was 92% with an 8% infertility rate. Among the infertile alpacas, one had poor follicular development, two had cystic follicles and the other two had endometritis.

According to earlier studies, the common presentations of infertility in alpacas were: congenital abnormalities of the reproductive organs, pathological abnormalities of ovaries or uterus and embryonic death and abortion (Vaughan and Tibary, 2006). In the present study, all 5 of the infertile alpacas showed acquired infertility and none showed congenital abnormalities of the reproductive organs or overt late embryonic loss/ abortion after pregnancy diagnosis.

Clinical assessment, diagnosis and treatment of poor follicular development: A 3 years old alpaca weighing 56 kg was diagnosed with poor follicular development. The alpaca exhibited normal sexual receptivity when presented to a male but failed to conceive despite several matings >6 months. Ultrasonographic examination upon diagnosis of infertility showed absence of significant follicular growth. Treatment with FSH resulted in appearance of two large follicles (>6 mm in diameter) on the left ovary. Treatment with hCG 24 h after last FSH injection resulted in ovulation. At 20 days post mating, pregnancy was confirmed by ultrasonography and a healthy female cria born 347 days after the time of mating. Alpacas are induced ovulators (Vaughan *et al*., 2004). Hence, normal sexual receptivity and copulation can be observed even when large follicles are not present on the ovaries. In this study, alpacas with follicular dysplasia accepted males normally but did not establish pregnancy presumably due to insufficient growth of ovarian follicles to the ovulatory size/stage of differentiation. However, the alpaca diagnosed with insufficient follicular development successfully became pregnant and underwent parturition after treatment with exogenous FSH/hCG. This indicates that a lack of follicular development or follicular dysplasia may be due to insufficient secretion or reduced sensitivity to endogenous gonadotropins.

Clinical assessment, diagnosis and treatment of cystic follicles: Two alpacas aged 4 and 5 years and weighing 67 and 82 kg, respectively were diagnosed with cystic follicles. The alpacas exhibited obvious sexual receptivity when presented to a male. The alpacas each mated with a fertile sire for several cycles over a period of 2 years but pregnancy diagnosis was negative after each mating. No pathological abnormalities of the reproductive tract were found using ultrasonography. However, 3 or more follicles >12 mm in diameter were detected on the ovaries of each animal and follicles persisted for at least 2 months. Treatment with 1000 IU hCG i.v. resulted in regression of cystic structures in both alpacas within 48 h. After corpus luteum regression 10 days later, normal follicular growth was observed and animals mated when new follicle reached 8 mm or greater. The two females treated for cystic follicles gave birth successfully at 347 and 351 days, post mating, respectively.

Ovarian cysts include cysts of the follicles and of the corpus luteum. Animals with follicular cysts show strong estrus behavior and accept mating repeatedly without ovulation. Many investigations have reported on the pathogenesis, diagnosis and treatment of follicular cysts in numerous species (Silvia *et al*., 2002; Forsdike *et al*., 2007; Castagna *et al*., 2004). Although, the diagnosis of follicular cysts in alpacas has been described in literature, reports of specific cases are limited. This study reports two cases of follicular cysts in alpacas with no previous pregnancy success. The cystic follicles were corrected in both animals using exogenous hCG and animals successfully became pregnant and gave birth.

Clinical assessment, diagnosis and treatment of endometritis: Two alpacas aged 5 and 8 and weighing 69 and 75 kg, respectively were diagnosed with endometritis. Both of the alpacas strained during urination. Thickened vaginal discharge with a putrid smell was present outside of the vulva. The alpacas exhibited sexual receptivity when presented to a male and mated with a fertile sire for several cycles over the course of 2 years. Ultrasonic examination after diagnosis of infertility showed thickening of the uterine wall. A small quantity of liquid was observed in the uterine lumen. Normal waves of follicular growth were seen during daily monitoring of follicular development. Ovulation was confirmed 48 h after copulation but pregnancy diagnosis at 20 day after mating was negative. Upon final diagnosis, treatment consisted of uterine flushing with warm 0.9% NaCl saline containing penicillin (5000 IU mL^{-1}) and streptomycin (10 mg mL^{-1}) daily for 7 days. After completion of treatment, the two alpacas then ceased to strain while urinating and no obvious vaginal discharge was detected. About 2 months later, the alpacas were mated. Pregnancy was confirmed 20 days after the mating in both cases and females gave birth at 344 and 350 days, respectively.

Endometritis occurs mainly due to endometrial infections caused by damage during delivery by retention of fragments of the placenta or by contamination introduced during artificial insemination (Sokkar *et al*., 1980; Maes *et al*., 2008; Sheldon *et al*., 2009). The disease impedes embryo implantation and further development, leading to infertility. The two cases of endometritis in this study were not attributed to contamination induced by artificial insemination as all matings attempted were done naturally. Thus, these animals likely developed endometritis and became infertile due to persistent low grade infection caused by dystocia or placental remnants remaining after parturition. Typical treatment regimes for endometritis include antibiotic treatments in combination with oxytocin and flushing of the uterus with sterile saline (Vaughan *et al*., 2004).

CONCLUSION

In this study, oxytocin was omitted from the treatment regimen and both animals successfully became pregnant.

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