

Clinical use of Reproductive Hormones:

- › **A hormone is a chemical messenger that coordinates the activities of different cells in a multicellular organism. The use of hormones is a major component of theriogenology. Hormone preparations are utilized as reproductive management tools, diagnostic aids and therapeutic agents.**
- › **The effective use of hormones in theriogenology requires knowledge of both normal reproductive endocrinology and the therapeutic characteristics of available hormonal preparations.**

Gland	Hormone	Chemical Class	Function
hypothalamus	Gonadotropin releasing h. GnRH	Peptide	FSH and LH release
	Prolactin releasing factor PRF	Peptide	Prolactin release
	Prolactin inhibiting factor PIF	Peptide	Prolactin retention
	Corticotropin releasing h. CRH	Peptide	ACTH release

- › **Gonadotropin Releasing Hormones (GnRH)**
- › **GnRH is produced by the neurons of the hypothalamus. The application of GnRH and its analogues in theriogenology is based on their ability to stimulate release of FSH and LH from the anterior pituitary following a single injection.**
- › **Indications**
- › **Cattle –**
 - › *** used primarily in the treatment of ovarian follicular cysts.**
 - › ***delayed ovulation or anovulation.**
 - › ***a cyclicity.**
 - › ***Improve pregnancy rates, and the chances of conception in cyclic non-breeders.**
 - › ***Oestrus synchronisation.**
- › **Horse –**
 - › **Induction of ovulation, single injection may not be effective requires frequent repeated doses.**

- > **Dose**
- > **Cow :0.25-0.5 mg**
- > **Sheep and goat:0.1 mg**

Gland	Hormone	Chemical Class	Function
Anterior Pituitary Gland	Follicle Stimulating h. FSH	Protein	1. Follicle growth 2. Estrogen release 3. Spermatogenesis
	Luteinizing h. LH	Protein	1. Ovulation 2. Corpus luteum formation and function 3. Testosterone release
	Prolactin	Protein	Milk synthesis
	Adrenocorticotropin ACTH	Poly-peptide	Release of glucocorticoid

FSH

1. ovarian and follicular growth and development.
2. Important for the synthesis of estrogen from the ovary.
3. Responsible for the anatomical integrity of the seminiferous tubules.
4. Necessary for the final steps of spermatid maturation and important in androgen secretion.

FSH is inhibited by high levels of estrogen, testosterone, and progesterone.

Indications:

Cattle:

- 1- Superovulation of donor cows for embryo transfer.
- 2- Treat anestrus.
- 3-treat bulls with impaired spermatogenesis and enhance descent of the testicle in cryptorchids is questionable.

Sheep and Goats:

Association with intravaginal progesterone sponges to advance the onset of the breeding season. (Superovulation).

Dose:

1- Cattle: 1500-3000 I.U.

2- Sheep and Goats: 500-600 I.U.

LH

1. Plays a role in follicular maturation and ovulation.

2. Necessary for the luteinization of follicular cells.

3. Important in the stimulation of the ovary to produce progesterone.

4. Stimulates growth of the interstitial (Leydig) cells and the secretion of testosterone.

Indications:

- used to bring about ovulation

- used in treating cows with ovarian follicular cysts. (nymphomania).

- produces temporary stimulation of the interstitial cells of the testes to produce testosterone resulting in an increase in libido.

- used to increase the size of the corpus luteum and increase the amount of progesterone when administered four days after ovulation has occurred.

Dose:

1- Cattle: 1500-3000 I.U.

2- Sheep and Goats: 500-600 I.U.

Note: In general FSH and LH function closely with each other to bring about their individual responses. The responses of each depend upon a proper level of the other.

Gland	Hormone	Chemical Class	Function
Posterior Pituitary	Oxytocin	Peptide	1. Parturition 2. Milk ejection

Oxytocin

1. Causes contraction of the smooth muscles of the uterus. Its action is enhanced by estrogen and inhibited by progesterone.

2. Causes contraction of the myo epithelium of the mammary gland.

Indications:**Cattle**

1. Induces milk let-down in heifers and in cows with mastitis.

2. Hastens uterine involution following dystocia, caesarean operation, and replacement of uterine prolapse, uterine trauma or hemorrhage.

Horses

1. Drug of choice for the induction of parturition

2. Causes expulsion of the fetal membrane

3. Induces milk let-down

Dose:

1- Cattle: 50-100 I.U.

2- Sheep and Goats: 40 I.U.

Gland	Hormone	Chemical Class	Function
Ovary	Estrogens (Estradiol)	Steroid	1. Female sexual behavior 2. Secondary sex characteristics 3. Maintenance of female duct system 4. Mamary growth
	Progestins (Progesterone)	Steroid	1. Maintenance of pregnancy 2. Mamary growth
	Relaxin	Polypeptide	1. Expanction of pelvis 2. Dilation of cervix
	Inhibin	Protein	Prevent release of FSH

The estrogens are steroidal hormones and produced primarily by the ovaries, placenta and corpus luteum. Progesterone decreases the effects of the estrogen and FSH and LH may be involved in estrogen secretion.

Types:

1-Estrone	E1
Estradiol-17B	E2
Estradiol-17 α	
Estriol	E3

Actions

Some important physiological actions of estrogens include:

1. Maturation growth and development of the reproductive organs.
2. Stimulation of normal physiological processes of the tubular reproductive tract.
 - A- growth of the uterine muscle
 - B- development of the endometrial lining of the uterus
 - C- increase the vascularity of the uterus
3. Induction of behavioral estrus
4. The production of edema in folds of the mucosa at the utero-tubal junction
5. Dilatation of the cervix
6. Under the influence of the estrogens the uterus is less susceptible to infection
7. They produce contractions of the uterus
8. They enhance the effects of oxytocin on uterine motility
9. The estrogens inhibit the secretion of FSH and LH via a negative feedback mechanism
10. They are required for the development of the secondary sex characteristics of the female including hair growth, deposition of body fat, mammary gland development.

Uses

1. They are used to evacuate the uterus in cases of fetal mummification, fetal maceration and pyometra.
2. They are used to induce abortion in all species.
3. They can be used in the treatment of postpartum metritis and retained fetal membranes.
4. Used in the management of misalliance in dogs.
5. To produce signs of estrus in anestrual animals. (no ovulation).

6. In virgin heifers and dry cows estrogen can be used to stimulate mammary development and lactation.

7. Large doses of estrogen after parturition can be used to inhibit lactation and relieve congestion of the mammary glands.

8. Used as growth promotants in beef cattle.

9. In treating male dogs with prostatic hyperplasia.

10. Can be used to decrease libido in males.

Side Effects

1. Prolonged use or large doses can produce cystic ovaries or ovarian atrophy.

2. Because of its effect on the ligaments, the estrogens predispose to prolapse of the vagina and rectum and dislocations and fractures of the pelvic bones.

3- In some species the estrogens in combination with progesterone may increase the incidence of cystic endometrial hyperplasia – pyometra.

Dose:

1- Cattle: 4-6 mg

2- Sheep and Goats: 2-3 mg

Progestogens (Progestins)

Produced by the corpus luteum (main source), placenta (especially of the ewe and mare after the first 1/3 and 1/2 of gestation respectively).

Action:

1. Progesterone causes growth of the glandular system of the endometrium of the uterus, and the secretions from the endometrial glands (uterine milk) for the nutrition of the ovum and the attachment of the embryo.

2. Progesterone plays a role in the maintenance of pregnancy (and pseudopregnancy) by providing a favorable environment for survival of the embryo.

3. Progesterone causes growth of the alveolar system of the mammary gland.

4. Progesterone inhibits the smooth muscle activity of the uterus - renders it less sensitive to oxytocin.

5. At high levels progesterone inhibits the secretion of FSH and LH via a negative feedback.

Uses

1. Prevent abortion due to an actual or possible progesterone deficiency.

2. Estrum deferment or suppression in the ewe, cow, sow, mare and bitch.

3. Synchronization of estrus in the mare, ewe, cow and sow.

4. In heifers the progestins are used to promote growth - suppresses heat

Dose:

1- Cattle: 125 mg

2- Sheep and Goats: 40 mg

Gland	Hormone	Chemical Class	Function
Uterus	Prostaglandin F2 α (PGF2 α)	Lipid	Regression of corpus luteum 2. Parturition

Prostaglandins

The prostaglandins are a group of compounds synthesized and found in many tissues of the body. The prostaglandins have been arranged into 8 major series according to chemical makeup: A, B, C, D, E, F, G & H. There may be different prostaglandins within a series.

Currently the only prostaglandin available commercially is prostaglandin F2 Alpha (PGF2Alpha).

Action

Prostaglandin F2 alpha is a potent luteolytic agent (except in the bitch and cat) resulting in a decrease in progesterone levels, with a concurrent increase in the secretion of FSH by the anterior pituitary and a return of normal estrus and ovulation within 4 to 6 days.

Some of the side effects associated with Prostaglandin F2 Alpha in mares include:

- a. Sweating
- b. A drop in body temperature
- c. Transient signs of colic, diarrhea and incoordination

2. Synthetic analogues of PGF2alpha: these do not produce the side effects in mares that are associated with the natural prostaglandin.

Uses

Mares:

1. treatment of prolonged diestrus (persistence of the CL).

2. to shorten diestrus.

3. breeding after foal heat

5. in the evaluation and treatment of endometritis.

Cow and Ewe:

1. evacuation of the uterus (mummified, pyometra, endometritis).

2. synchronization of estrus.

3. induce abortion in heifers and ewes that are mated too young.

4. induction of early parturition in cows, e.g. in cases of uterine fetal oversize.

5-Treatment of luteal cysts

Note:

1. Prostaglandin F2 alpha should only be given to pregnant animals if abortion is desired.

2. PGF2 alpha should not be administered by the intravenous route.

3. Contact with the skin should be avoided.

Dose:

1- Cattle: 15-25 mg

2- Sheep and Goats: 7.5-10 mg

Placental hormones

1- Pregnant mare serum gonadotropin (PMSG) now called equine chorionic gonadotropin (eCG).

A protein hormone produced by the endometrial cups of the mare from about 40 to 140 days of pregnancy. It contains both FSH and LH, but its activity is mainly FSH.

Indications:

Cattle:

1- Superovulation of donor cows for embryo transfer.

Sheep and goats:

1- Association with intra vaginal sponges.

Dose:**1- Cattle: 1500-3000 I.U.****2- Sheep and Goats: 500-800 I.U.****2- Human chorionic gonadotropin (hCG)**

A protein hormone produced by chorionic epithelial cells of human placenta. It is excreted in the urine and reaches peak levels at about 50 days of pregnancy. Its activity is predominantly LH, it also has a longer half-life than LH.

3. Human menopausal gonadotropin (hMG)

Extracted from the urine of menopausal women, this has primarily an FSH-like action. Used to a limited extent in superovulating donor cows for embryo transfer. It has a shorter biological half-life than eCG.

Melatonin

Melatonin hormone produced by the Pineal gland. Level of secretion depends on photoperiod,

Increasing day length inhibiting

Decreasing day length stimulating

