

Practical Manual on Veterinary Gynaecology

Unit 1



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MAHATMA JYOTIBA FULE COLLEGE OF VETERINARY & ANIMAL SCIENCE
CHOMU, JAIPUR (RAJASTHAN)**

PREFACE

This Laboratory Manual has been prepared for the undergraduate students of B.V.Sc. & A.H. in accordance with the syllabus designed by the Veterinary Council of India. The efforts have been made to make the manuscript worthy, realistic and easily understandable for the students, teachers and scientists in the field of Veterinary Gynaecology. We hope this manual will serve very useful tool to the undergraduate and graduate students of Veterinary Science who are undergoing courses in veterinary Gynaecology (unit-1).

It's our pleasure to thank Dean, Mahatma Jyotiba Fule College of Veterinary and Animal Sciences, Chomu, Jaipur for providing necessary facilities and rendering all helps in preparing this course manual.

Suggestions for improvement are welcome from scientists, teachers and students.

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FOREWORD

I am very happy to go through the Practical Manual entitled “Veterinary Gynaecology (unit-1)” Department of Veterinary Gynaecology and Obstetrics, M.J.F. College of Veterinary and Animal Sciences, Chomu, Jaipur (Raj.).The manual covers the practical syllabus of undergraduate course (Veterinary Gynaecology, unit-1) prescribed by Veterinary Council of India (MSVE2016) for B.V.Sc& A.H programme.

The manual is a good attempt and is based on cumulative experience of teaching undergraduate courses. The language used in the manual is simple and lucid. The outline and description of practical exercises covering objectives, materials required, procedure and observations to be taken have been nicely presented which would be hopeful in conducting practical’s more effectively.

I hope this manual will make its own place in the libraries of Veterinary and Agricultural Universities, Veterinary and Animal Science College and various Livestock Institutions in near future.

I congratulate the authors for the efforts put in bringing out this practical manual.

Dean

MJF College of Veterinary &
Animal sciences, Chomu, Jaipur

CERTIFICATE

Certified that this is a bonafide record of practical work carried out in the laboratory of the course Veterinary Gynaecology (unit-1) by _____ Roll No. _____ of 4th year B.V.Sc. & A.H. course during the year_____

Date :

Place: CHOMU, JAIPUR

Signature of Head of Department

Signature of Course Teacher

ANNUAL BOARD EXAMINATION

Evaluated the practical record submitted for the Annual board practical examination held on_____ for **Veterinary Gynaecology (unit-1)**, at M. J. F. college of veterinary and animal science, Chomu, Jaipur, Rajasthan.

**Signature of
Internal Examiner**

**Signature of
External Examiner**

SYLLABUS: UNIT- 1 (VETERINARY GYNAECOLOGY)

- Study of female genital organs using slaughter house specimens
- Oestrus detection aids
- Techniques of rectal palpation of female reproductive tract
- Gynaecological equipment and instruments
- Vaginal exfoliative cytology and vaginoscopy
- Ultrasonography of female reproductive tract
- Surgical procedures on the vulva, vagina and uterus
- Study of pathological specimens of female genital tract
- Demonstration and practice of ovario-hysterectomy and pan-hysterectomy
- Diagnostic procedures in investigation of infertility in female animals

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10		Pregnancy diagnosis in farm animals by clinical examination		
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Practical No. 1

STUDY OF FEMALE GENITALIA AND ITS BIOMETRY

Objectives:

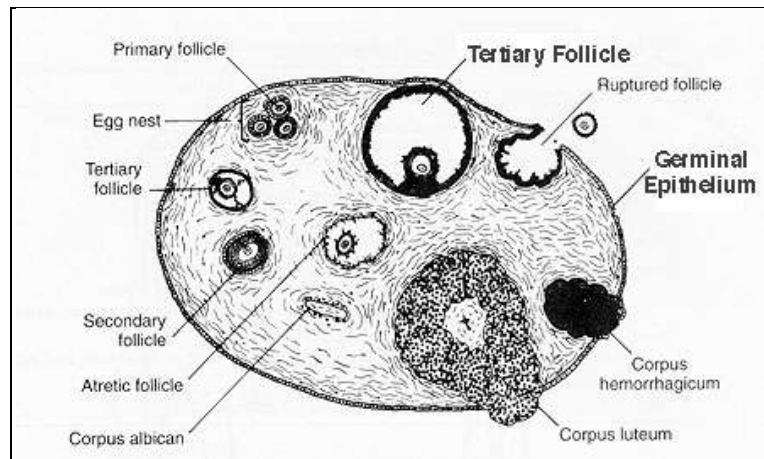
To be acquainted with the gross morphology of female genitalia. This will help clinical differentiation of abnormal condition and proper application of reproductive technology.

1. Ovary

The ovary consists of a stroma or network of connective tissue and blood vessels surrounded by a covering of peritoneum. Within the ovary are interstitial cells, primitive ova, developing or secondary ova or follicles, maturing or mature Graafian follicles, atretic or degenerating follicles and developing, mature or regressing corpus luteum. The ovary is supported and attached by the portion of broad ligament called the mesovarium. In farm animals the ovary lies in an open ovarian bursa (a pouch consisting mainly of thin peritoneal fold of mesosalpinx) which is wide and open in cattle and sheep. In swine, it is well developed and although open it largely encloses the ovary.

The ovaries not only perform the important function of producing egg cells but also produce hormones. These hormones play an indispensable role in preparing the reproductive tract for pregnancy and in maintaining and delivering the offspring and its associated membranes.

- A. Cow:** The ovary is oval in shape, varies in size depending upon the structures present and the right ovary is usually slightly larger than the left. The mature Graafian follicle is usually about 1-2 cm in diameter and smooth, convex, thin-walled and fluctuates on palpation. The corpus luteum is usually about 1.2-3.2 cm in diameter and may comprise up to three quarters of the size of the ovary. Its consistency is liver-like and it usually has a protrusion above the surface of the ovary called crown or knob which is, however, not present consistently.
- B. Doe:** The ovary may be round, oval or elongated and less than half the size of that of a cow. It is smooth and shiny, with large follicles often near the surface (up to 1.2 cm diameter) often having a bluish tinge, while the corpus luteum gives the ovary a pink appearance. When several large follicles are present, the ovary may resemble a cluster of grapes. The right-ovary is generally more active than the left.
- C. Sow:** The ovary is oval in shape and slightly larger than that found in the ewe/doe and appears as a cluster of grapes due to presence of multiple follicles and/or corpus luteum. Follicles are normally about 7-8 mm and corpora lutea are about 12-15 mm in diameter.



Sectional view of ovary

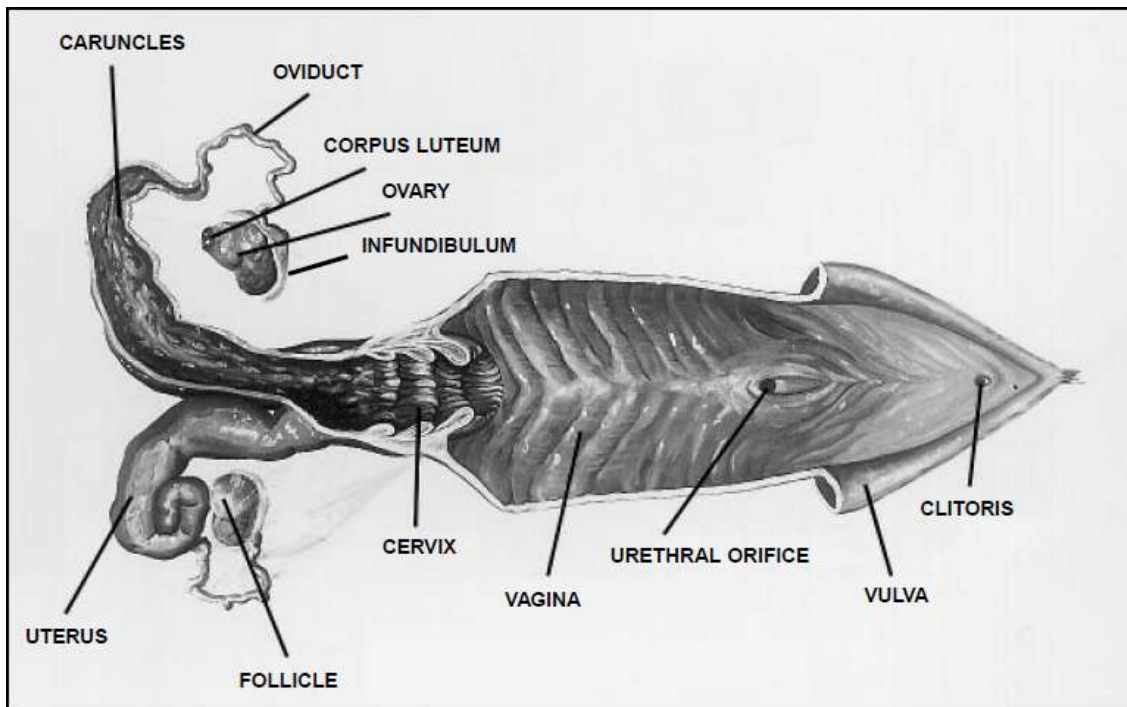
2. Oviducts or fallopian tubes:

The oviducts are a pair of convoluted tubes extending from near the ovaries to the uterine horns and becoming continuous with the tips of the uterine horns. The oviduct is divided into three segments. The narrow distal short segment attached to the tip of the uterine horn is called the isthmus. The more dilated and major portion (about half of the total length) of the oviduct is called the ampulla. The funnel-shaped abdominal opening near the ovary is called the infundibulum which has a fringe of irregular processes called the fimbriae. The fimbria has partial attachment to the lateral side of the ovary and to the utero-ovarian ligament medially. In the centre of the fimbria is the opening of the infundibulum called ostium abdominale.

The oviduct has the unique function of conveying the eggs and spermatozoa in opposite directions, almost simultaneously. The utero-tubal junction controls in part, the transport of sperm from the uterus to the oviduct. The oviduct provides an optimal environment for union of the gametes and for development of early embryo.

A. Cow: The oviducts are 20-30 cm long, tortuous, wiry, hard, nearly cartilaginous and maybe embedded in the mesosalpinx (portion of broad ligament supporting the oviduct). The oviducts are difficult to palpate on rectal examination and the technique is to slip several fingers into the ovarian bursa, and palpate the oviduct between them and the thumb or by bimanual rectal and vaginal examination. There is a marked flexure at the transition of the isthmus with the elongated curving end of the uterine horn.

- B. Doe:** Oviducts are difficult to be distinguished from the uterus as there is no distinct line of demarcation. The tubes are long, sinuous and very tortuous near the infundibulum and may vary from 7.2 to 25 cm in length.
- C. Sow:** The oviduct is 5-30 cm long, has a slightly tortuous course around nearly the entire circumference of the ovarian bursa.



Anatomy of reproductive tract

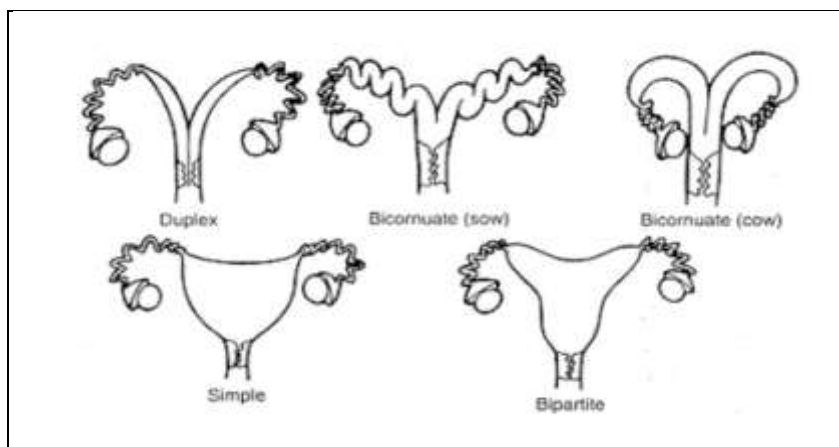
3. Uterus:

It is a muscular membranous structure extending from the utero-tubal junction to the cervix and consists of two uterine horns (cornua), a body and a cervix (neck). In the sow the uterus is of bicornuate type characterized by a small uterine body just anterior to the cervical canal and two long uterine horns. Fusion of the uterine horns of the cow and doe near the uterine body gives the impression of a larger uterine body than actually exists and has resulted in their uteri being classified as bipartite. For the cow and sow the overall length of the uterus may range from 35-60 cm while in the doe it is less than half and size of that of the cow or sow. In the cow, doe and sow the uterine horns account for 80-90% of the total length.

The uterus serves a number of functions like sperm transport from the site of ejaculation to the site of fertilization in the oviduct, regulation of the function of the corpus luteum, initiation of implantation, maintenance of pregnancy and helping in the process of parturition. The major function is to retain and nourish the embryo or foetus. Before the embryo becomes attached to

the uterus, the nourishment comes from yolk within the embryo or from uterine milk which is secreted by glands in the mucosal layer of the uterus.

- A. Cow:** The true bifurcation of the horn is found at the site of the junction with the body of the uterus. A false or external bifurcation, however, is located further forward at the site where both horns are connected by the dorsal and ventral inter-cornual ligaments. The clinical significance of the inter-cornual ligament is that it helps in retraction or rolling up of the uterus during examination. It should be attempted during rectal examination in all animals in which the cervix is found to be freely movable. Retraction is completed by grasping the ventral inter-cornual ligament with the middle fingers lifting and pulling the uterus back into the pelvic cavity. The uterus is attached dorso-laterally by the broad ligament called mesometrium. The caruncles are 70-120 in number and convex in shape and are arranged in four rows.
- B. Doe:** The caruncles are smaller than in cows and are approximately 88-120 in number, concave with a depression on the free surface, arranged in four rows and are very distinct even in virgin does. Older parous animals commonly have melanin pigment in the caruncles and inter caruncular space.
- C. Sow:** The horns are long and tortuous (folded and convoluted) resembling thick-walled intestines that are freely movable because of the long broad ligaments. Endometrium usually has prominent longitudinal folds which fade gradually towards cervix.



Types of uterus

4. Cervix

The cervix uteri or neck of the uterus is a thick-walled tubular sphincter like structure that projects caudally into the vagina. It is cylindrical in shape. In all species except the sow it projects somewhat into the cavity of the vagina, thus forming the vaginal part of the cervix. Around this projection there is a more or less annular space (except in the sow) called the

vaginal fornix. The longitudinal cervical canal opens into the body of uterus via the internal uterine opening and into the vagina via the external uterine opening. The canal is tightly closed except during oestrus, parturition and a short period after parturition. When the canal is closed it is sealed by a plug of clear mucoid secretion. The mucosa of the cervix is rich in mucus secreting cells.

The cervix plays several roles in the reproductive process

- A. It facilitates sperm transport through the cervical mucus to the uterine lumen.
- B. It acts as a barrier against ascending type of infection.
- C. It acts as a sperm reservoir and it may play a role in the selection of viable sperm, thus preventing the transport of non-viable and defective sperm

A. Cow: The cervix is about 5-10 cm in length and (1.5 - 5.0 cm in diameter). It can always be recognized by palpation per rectum as it is hard and thick-walled and used as a landmark when searching for the ovaries. The cervical canal has 3-4 tall circular/folds or transverse interlocking ridges known as annular rings which project toward the vagina. These circular folds are intersected by longitudinal folds. The vaginal part of the cervix is partly fused ventrally with the floor of the vagina; consequently the vaginal fornix is much reduced ventrally, although dorsally it is well developed.

B. Doe: The cervix resembles that of the cow and the short body of the uterus joins with the firm and fibrous cervix. The cervix has annular rings often about 5 cm, and commonly 2.5-5.0 cm long.

C. Sow: The cervix possesses several highly distinctive features. The cervical canal is funnel shaped and the rings are in a corkscrew arrangement which conforms to the spiral twisting of the tip of the boar's penis. In absolute terms, it is longer (15-20 cm) than any other species, poorly defined and is directly continuous with the vagina. The canal has the usual longitudinal folds, but in addition to these there are rows of stud-like projections each about 1 cm in diameter which interlock with each other. These projections fade out gradually towards both the internal and the external uterine openings, as a result, the external opening is not distinct, and hence the vaginal part of the cervix and the vaginal fornix are absent.

5. Vagina:

It is a muscular membranous structure, tubular in shape, thin-walled and quite elastic. It runs from the vaginal part of the cervix uteri to the vestibule and is the female organ of copulation.

- A. Cow:** It is about 25-30 cm long in non-pregnant animal. On the ventral floor beneath the mucosa and running the length of the vagina are the two Gartner's ducts, remnants of the primitive mesonephric or wolffian ducts. Cysts of these structures occasionally be observed.
- B. Doe:** It is about 5.5-10.5 cm in length and its ventral part contains many lymph follicles. A shallow sub urethral diverticulum is present on the floor and occasionally Gartner's ducts, located ventrally on each side of the vagina, are distended with thick yellowish mucus.
- C. Sow:** It is about 7.5- 11.5 cm long, small in diameter and mesonephric ducts are occasionally present. There is no vaginal fornix.

6. Vulva or External genitalia:

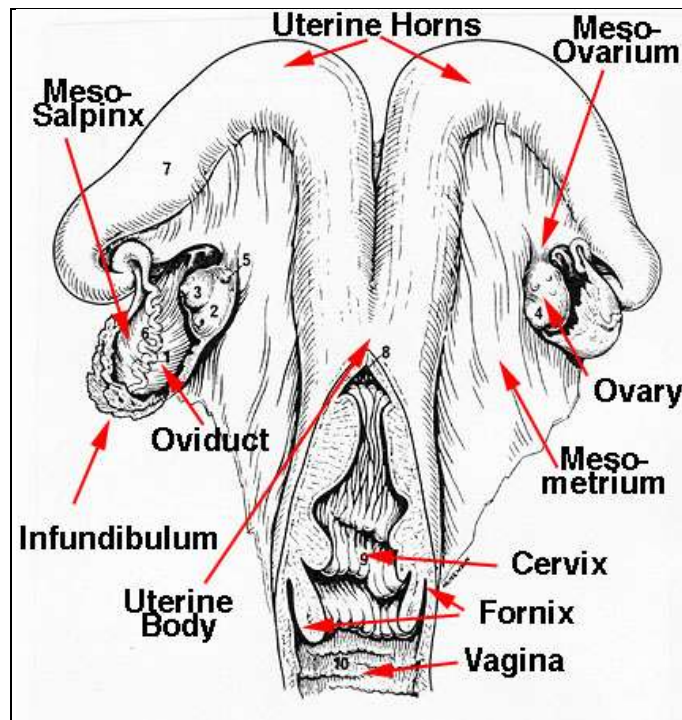
It consists of two lips (labia), dorsal and ventral commissures, clitoris (homologous to glans penis) and the vestibule. The boundaries of the vestibule are the labia of the vulva caudally and the point immediately cranial to the urethral orifice. The vestibule is 10-12 cm in length in the cow, half that length in the sow and one-quarter that length in the doe. The urethra opens into the cranial ventral portion of the vestibule. During parturition the vestibule acts as the point of attachment for the entire genital tract to construct upon when expelling the foetus. The vestibular glands are active during oestrus and secrete lubricating mucus which accounts for the moist appearance of the vulva during oestrus.

- A. Cow:** External urethral orifice is narrow and ventral to it is the large suburethral diverticulum. A pair of Gartner's ducts open on the side of the urethral orifice. The external visible portion of the clitoris is small in size as the greater part of it is buried in the mucosa. The vestibular glands two in number, each opens into lateral wall of vestibule 2.5 cm caudal to the vagina. The vulval lips are pointed, both commissures being acute.
- B. Doe:** The vestibular glands have received little or no attention and are frequently absent. Black pigmentation may be present in the vestibule. Clitoris is not conspicuous and normally should not be visible between the lips of vulva. A large clitoris suggests that the doe is actually an intersex. The labia of the vulva are thick but not very prominent and the ventral commissure projects downward tapering in a point.
- C. Sow:** The external urethral orifice is bounded laterally by longitudinal thick folds. Gartner's ducts may be present. The vestibular glands open in two lines one on each side of the ridges which border the urethral orifice. The clitoris is long and sinus, terminating in a small point or cone. The clitoris fossa being either absent or very shallow. The labia vulva are thick, the dorsal commissure is rounded while the ventral commissure is very pointed.

Materials required and procedure of examination

1. Freshly procured female genitalia from slaughter house.
2. Forceps
3. Scissors
4. Scalpel
5. Knile
6. Vernier calipers
7. Thread
8. Measuring scale

The genital organs should be excised from the carcass immediately after slaughter, before any gross changes occur in it. Efforts should be made to obtain the complete genital organ from vulva upto ovaries. The organ should be cleaned; dung, dirt, blades of grass or any material soiling it would be removed. Then it should be put in a polythene bag or wrapped in a wet towel and brought to the laboratory. The organ should be placed on the laboratory table in normal position. Extraneous tissues, ligaments and other structures attached to different parts of the genital organ should be removed with the help of scissors, scalpel, knife etc. Different parts of the genital organ should be examined for size, shape and structures present if any. Any abnormality in any portion of the genital organ should be recorded. Various measurements of different parts of the genital organ should be taken with the help of scale Small measurement may be taken with the help of slide callipers. A thread may be used for taking long measurements. The organs may be cut open to record the condition of the inner structures.



Reproductive tract of cow

EXERCISE

1. Measure dimensions of different parts of female reproductive tract and write down the observations.

Species of the genital organ (Bovine/ Caprine/ Ovine/ Swine)

Date of collection

Vulva	Condition	
	Length (ventral commissure to urinary meatus)	----- cm
	Breadth (Diameter at the middle)	-----cm

Vagina	Condition	
	Length (Urinary meatus to external os)	---- cm
	Breadth (external diameter at the mid point)	-----cm

Cervix	Condition	
	Length (external os to internal os)	----- cm
	Breadth (actual external diameter at the middle)	-----cm
	No. of annular ring	-----

Body of uterus	Condition	
	Length (internal os to point of true bifurcation or the horns)	
	Breadth (diameter at the midpoint)	
	No of cotyledon	

	Condition	Left	Right
Horn of uterus	Length (distance between point of internal bifurcation to the tip) Breadth (diameter at the base of the horn) No. of cotyledon		
Fallopian tubes	Condition Length (distance between uterotubal junction and the fimbrae) Breadth (diameter at the midpoint)		
Ovary	Shape (ovoid, round, elongated, flat irregular, berry shapes) Length (distance between anterior and posterior pole) Breadth (Distance between medial and lateral surface) Thickness (distance between attach and free boarder) Corpus luteum No. of CL resent Type (growing/maternal/regressing) Location Sizes (diameter)		a:----- cm b:----- cm
Follicie	Number Size (small/ medium/ large or Graafian) Location Consistency (tense/ fluctuating/ soft) Any other condition Type (open/closed)		
Ovarian bursa	Condition (free/ adhered) Type (Open/closed)		

Signature

Practical No. 2

PALPATION OF FEMALE GENITAL ORGANS OF CATTLE

PER RECTUM

Objectives: Transrectal examination or palpation represents the only practical diagnostic method permitting direct examination of the genital organs of a cow or buffalo of breedable age.

The objective of the study is to gather information regarding the reproductive status of the animal and to differentiate the abnormal condition of the genitalia from the normal state as well as to ascertain pregnancy.

Materials required:

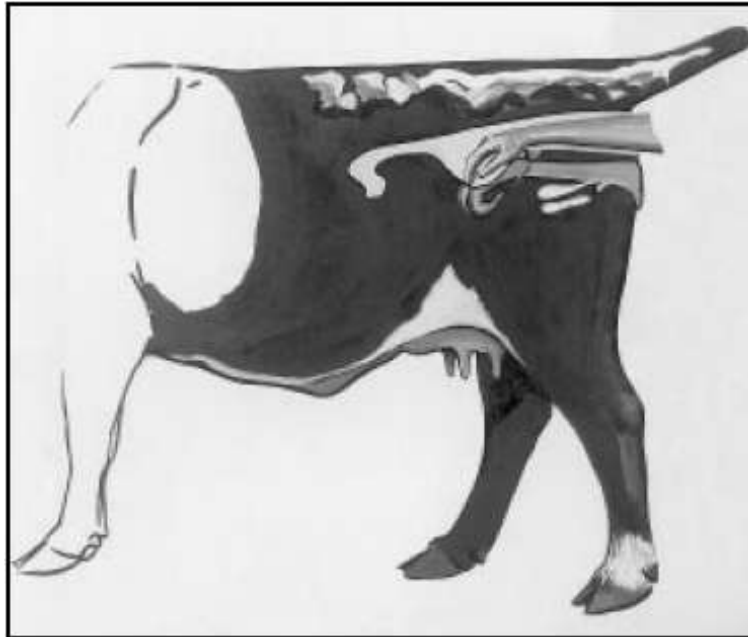
1. A rubber obstetrical arm sleeve with attached hand glove.
2. Rubber or plastic apron or rubber gown.
3. Rubber gum boots.
4. Towel
5. Non irritating lubricant such as antiseptic ointment, mild soap solution or oil.
6. Slide calipers
7. Travis/ Service crate.

Procedure:

1. Prior to actual rectal examination complete breeding history including the date of last calving, date and number of services, information on earlier diseases affecting the reproductive organs should be noted.
2. The animal should be properly restrained or well secured in a service crate before rectal examination to avoid injury to the examiner from possible kicking or untoward movement of the animal.
3. One or two assistants should be ready to control the animal, one at the front of the animal and the other should hold the tail away from the examiner's arm.
4. The finger nails should be short and no rings should be worn on the examining hand. The gloved hand should be well lubricated. It is advisable to palpate with the hand which is not used for writing so that findings can be recorded while examining the animal.
5. The hand is inserted gently into the rectum with the fingers forming a cone. Faecal material are to be removed by back raking to enable easy exploration, with the mucosa of rectum being the only structure between the fingers and the organs to be examined.
6. The hand and fingers are advanced beyond the organ or structure to be palpated. Each organ should be examined starting from cervix to the ovary. The results of the examination are to be recorded by the operator or by an assistant.
7. Frequent removal of the hand from the rectum during the process of removing the faecal material should be avoided. This may lead to aspiration of air into the rectum and its consequent distension making palpation of the genital organ impossible. The

distension is eliminated by grasping the most posteriorly located, contracted fold of rectum and expressing the air by gentle backward movement of the fold or by stimulating peristalsis by pinching the rectal wall which will help in the evacuation of the animal's back should not be pinched down since this tends to fill the rectum with an air.

8. The examination should cease if trauma to rectum becomes apparent with the appearance of blood on the sleeve or glove or by discharge of bloody faecal material.



Transrectal palpation

Examination of various reproductive organs:

- A. Cervix: It is recognized as a firm, cylindrical, somewhat nodular structure lying on the midline of the pelvic floor. The location of the cervix is the first step in examination of the uterus. The diameter of the cervix can be measured by grasping the cervix per rectum and the external diameter at the point nearest to the middle of cervix is palpated with the thumb and index finger and recorded. Slide calliper may be held in the other free hand and the sliding jaws be moved back and forth till the distance between the two jaws coincided with the external diameter of the cervix as visualized mentally by the fingers of the inserted hand. The common abnormalities of cervix are cervicitis, cervical abscess or kinked cervix.

Physiological and pathological conditions associated with position and freedom of movement of cervix.

Cervix predominantly pelvic and freely movable	Cervix abdominal and fixed
Normal non-pregnant	Pregnancy after 70 days
Pregnancies upto 60-70 days	Pyometra and hydrometra with uterus containing more than 2 litres of fluid
Post parturient involution more than 14 days after parturition	White heifer disease in which more than 2 litres are entrapped in uterus.
Pyometra and hydrometra with exudates not more than 2 litres	Extensive lymphoblastomatous lesions of uterus
Chronic accumulation of exudates uterus metritis without. Extensive adhesions appreciable.	Foetal mummification and maceration. Extensive ovarian tumours.

- B. Uterus: If the cervix has been found to be freely movable, the uterus can be retracted by grasping the ventral intercornual ligament with the middle fingers and pulling the uterus back, into the pelvic cavity. The external diameter of left and right horns can be measured at the point nearest to the external bifurcation based on palpation as described for the cervix.
- C. Ovaries: They are suspended approximately 5 cm laterally from the ovarian end of the uterine horn. The most common structures palpable on ovaries are corpus luteum (liver like consistency) and follicle (round, smooth). The palpable abnormalities are ovarian hypoplasia, atrophy of ovaries, ovaritis, cysts of ovaries, ovarian tumours, delayed ovulation, anovulation and persistent corpus luteum.

Characteristic changes of the genital organ during the oestrous cycle in the cow

Days of oestrous cycle	Clinical findings		Observed external signs
	Rectal palpation		
	Ovaries	Uterus	
16-18	CL 20-25 mm, follicles, 8-10 mm	Slight uterine tone	No signs of oestrus
19-20	CL 10-15 mm, follicles, 12-15	Marked uterine tone, irritability to	Proestrus; vulva slightly swollen, vestibule slightly

	mm	manipulations	red, some mucus in vagina, a few signs of oestrus present
21	CL, less than 10 mm, follicle 20-25 mm, soft and smooth, after ovulation, soft area on Ovary or crater like depression	Marked uterine tone due to increased myometrial activity, oedema of endometium	Vulva swollen, vestibule reddened, copious mucous discharge, other signs of oestrus present
1-4	New C.L, reaches 15 mm by 4 day, rather soft, old CL, less than 5-6 mm hard and fibrotic	Post oestrus oedema for 2-3 days	1 day post oestrus slight discharges and oestrous activity. Post-oestrus/metoestrous bleeding
4 – 15	8 day CL. 18-20 mm, 10 day, CL, 20-30 mm	Physiologically flaccid	Vestibular region pale. No signs of oestrus

D. Oviduct and ovarian bursa: The ovarian bursa is palpated by locating the mesovarium medial or lateral to the site of attachment of the ovary. All fingers are then bent and slid underneath the mesovarium into the ovarian bursa. Spreading of fingers exposes the bursa which then is hooked onto the thumb and lifted up. The oviduct is then recognized as a coiled cordlike structure and only those abnormalities associated with enlargement of the oviduct are detected clinically. Normally the diameter of the oviduct is 2-3 mm and more than this diameter indicates presence of fluid. In normal animals, the ovarian bursa should be free from adhesions. The clinically detectable abnormalities are segmental aplasia of oviduct, hydrosalpinx and those involving the mesosalpinx and the ovarian bursa.

EXERCISE

1. Palpate the genital organs per-rectally and write the observations

Name of the owner

Address

Species

Breed

Age

Breeding history

Clinical findings

VULVA

Swelling/oedema	Present/ Absent
Hyperaemia of mucous membrane	Pink, Pale, Moist, Dry.
Physical characteristics of vulvar/vaginal discharge	
Colour	Transparent/Opaque/Cloudy/dirty
Consistency	Thin/Thick
Nature	Stringy/ Non-stringy/ Expelled as pool of mucus or copious.

VAGINA

Any Palpable Structure

CERVIX

Size (diameter)	----- Cm
Shape	Normal/ Kinked
Patency	Open/Closed
Consistency	Relaxed/Firm

UTERUS (horns)

Symmetry/ Asymmetry:	Left	Right
Size (diameter):		
Tonocity (Tonic /atonic):		
Consistency (Thin/ Thick/Flaccid):		
Presence of any material inside:		
Overall anatomy of horn		

OVARY

Shape (round/ovoid/elongated/flat) :

Size (gram/pea/marble/betelnut/ping pong ball):

Consistency (firm/soft):

Surface (smooth/rough):

Any structure present:

Medium sized follicle (<7 mm):

Large sized follicle (>7 mm):

Preovulatory follicle:

(Very soft follicular wall)

Corpus haemorrhagicum:

(a soft slightly elevated area or a crater like depression in the site preoccupied by a Graafian follicle)

Mature corpus luteum (a firm, knob/like well

Defined protrusion with a crown sometimes)

Present/absent

Present/absent

Regressing corpus luteum

Present/absent

Present/absent

(hard nodular protrusion)

Follicular cyst (2.5 cm, multiple on both

Ovaries, thin walled, more common)

Present/absent

Present/absent

Luteal cyst (2.5 cm, often single, thick

Walled, less common)

Any other structure

Condition of oviduct

Comments

Signature

Practical No. 3

DETECTION OF OESTRUS BASED ON CLINICAL SIGNS IN CATTLE, PIG AND GOAT

Objectives:

1. Oestrus detection techniques are the key to enhance reproductive performance but fault in oestrus detection continues to be a major cause of low reproductive efficiency and hence stress is laid on proper detection of oestrus.
2. The objective of the study is to record various behavioural and physical changes of animal at oestrus and to be acquainted with clinical changes in genitalia of animals during oestrus so as to determine proper time of breeding.

Materials required:

1. Cow/doe in oestrus.
2. Protective clothing for clinical examination.

Procedure: The cow or doe in oestrus should be observed carefully from a distance and various behavioural and physical signs are recorded. Then the cow should be examined per rectum for changes revealed by the genital organ.

A. Cow:

No.	Physical Signs	No.	Behavioural changes
1	Copious, clear, stringy mucous discharge from vulva	1	Frequent bellowing
		2	Restlessness
		3	Frequent urination
2	Swelling of vulva-vulvar winkles become less prominent	4	Mounting over herd mate
		5	Alertness (head raised)
3	Congestion of vulval mucous membrane	6	Raising of tail
		7	Standing to be mounted by bull, cow or heifer
		8	Drop in milk yield
		9	Lack of appetite

Changes of the genital organ as detected on rectal palpation:

- a. Cervical relaxation: Cervix is felt softer and remains open. A depression felt on the external os cervix is indicative of an open cervix.

- b. Uterine tone: The uterus is felt turgid varying in degree from good tone to weak tone.
- Good: The horns of the uterus is felt turgid and curled into a rather tight configuration on rectal palpation.
 - Moderate: The horns of the uterus are turgid but without definite coiling.
 - Weak: The horns of the uterus develop turgidity immediately after rectal palpation and offer slight resistance to touch.
 - No tone: The horns of the uterus are flaccid without any detectable turgidity and offer no resistance to touch.
- c. Ovarian changes: Presence of large fluctuating follicle with or without regressing corpus luteum in either ovary indicates.

B. Sow:

Behavioural changes:

1. Restlessness
2. Grunting sound
3. Stands near gate of the shed
4. It shows a typical symptom called standing reflex, when it allows to be touched and when pressure is put on back it stands still.
5. Frequent urination
6. Mounting on other animals
7. Drop in milk
8. Shows less interest to feed

Changes in external genitalia :

1. Pronounced vulvar swelling
2. Congestion and hyperaemia of vulvar mucous membrane
3. Occasionally vulvar discharge

C. Doe:

1. Wagging of tail
2. Bleating frequently
3. Restlessness
4. Reduced appetite
5. Reduced milk yield
6. Mounting lock mates (uncommon)

7. Standing to be mounted by teaser buck/fertile buck

Changes in external genitalia:

1. Swelling of vulva
2. Hyperaemia of vulvar mucous membrane

EXERCISE

1. Write down the clinico-gynaecological changes during estrus

Species:

Date and time of onset of oestrus behaviour:

Behavioural signs observed:

Physical signs observed:

Changes of the genital organs as detected on rectal palpation:

Cervix: Relaxation (relaxed/not relaxed)

Patency (open/closed)

Uterus:

Left

Right

Size of horns

Tone of uterus

(good/moderate/weak/absent)

Ovary:

Palpable follicle (present/absent)

CL (mature/growing/regressing/absent)

2. Write down the behavioural sign and physical changes occur in the genitalia of mare and buffalo?

Signature

Practical No. 4

Preparation and examination of vaginal smears for detection of estrus in bitches (vaginal cytology)

Under the effects of estrogen initially, and progesterone later, the uterine lining also changes in a manner similar to that seen in the vaginal vault. Endometrium prepares for implantation through a remarkable increase in wall thickness and glandular activity. Initially, these changes are associated with some bleeding. This uterine hemorrhage accounts for the vaginal bleeding associated with proestrus and, in some bitches, estrus. The changes present in the vaginal vault during proestrus and estrus are reflected in the appearance of exfoliated vaginal epithelial cells.

Objectives

- To assess the stage of estrus.
- To guide the owner for the approximate date of future mating.
- To detect the infection, if any, during the estrus.

Materials required:

1. Sterilized swab with blunt probe
2. Sterilized cleaned microslides
3. Leishman stain/ new methylene blue
4. Compound microscope

Procedure

Collection of vaginal sample through cotton swab technique

- Separate the vulvar lips with one hand and pass a sterile 5-7inch-long cotton tipped applicator into the dorsal commissure of the vulva.
- Press gently against the caudodorsal surface of the vaginal vault to avoid the clitoral fossa and then advanced craniodorsally towards the vertebral column until it goes over the ischial arch. The swab is inserted at least the distance needed to reach the pelvic canal.
- Applicator is then rotated a complete revolution in each direction and withdrawn. Bitch may feel discomfort in absence of vaginal discharge, so it is advisable to moisten swab with 2-3 drops of normal saline.
- Avoid passing swab into small blind pocket (clitoral fossa) as it is painful to bitch & clitoral cells may be confused with superficial vaginal epithelial cells.

- Take out the swab and roll it gently from one side of the slide to the other. Don't press firmly or rub or smear the cotton against the glass because the result of either procedure is non-diagnostic material.
- Prepare one or two such slides air-dry them and then dipped once/twice in 95-100% methanol to prevent cellular distortion if the base of stain is not alcohol. Such slides can be stained immediately or at a later date.

Staining procedure

- Several stains shown to be excellent but generally it should be easy to use, inexpensive, stored well over a period of time / have long shelf life and provide a permanent slide that can be saved for longer time.
- Leishman's stain (5% in alcohol) can be used.
- Flood the slide with the undiluted Leishman's stain and leave for 1-2 minutes.
- Dilute the stain with double the volume of normal saline and evenly spread it by blowing the air over it and leave for 5-15 minutes.
- Wash the slide, clean the back of slide and air-dry it. Observe it under microscope at 10X first then at 40X.
- Other stains that can be used are Wright's stain, Geimsa's stain, Wright-Giemsa stain (modified Wright's stain), Diff-Quik stain (Hartman-Leddon Co. Inc.) and New methylene blue stain.

Classification of vaginal cells

Basal Cells

- Lie at the basement membrane of vagina.
- Not normally exfoliated.
- Give rise to other cells.

Parabasal cells

- Healthiest and smallest of vaginal cells
- Round/slightly oval, have large nuclei (well stained)
- Relatively small amounts of cytoplasm

Intermediate cells

- Reflect the first step in cell death.
- Cells are larger.
- Relatively larger amounts of cytoplasm and smaller nuclei.
- Small intermediate cells: Slightly larger in size than parabasal cells, smooth oval shape.
- Large Intermediate cells: Twice as big as parabasal cells, rounded irregular bodies.

Superficial cells

- Largest cells with sharp, flat, angular borders
- Stain poorly with small pyknotic or fading nuclei. Superficial-Intermediate Cells
- Have relatively healthy nuclei
- But have sharp, flat cell border typical of superficial cells.
- Indicate a strong estrogen effect on vaginal lining.

Anuclear Squames (Keratinized epithelial cells)

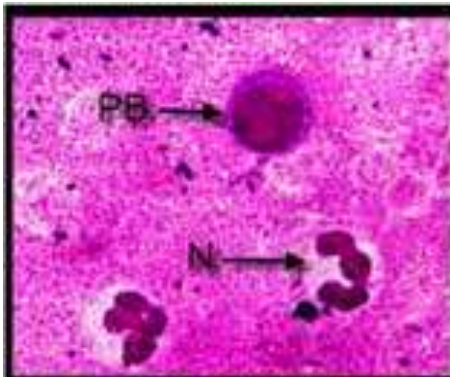
- Dead, large, irregular vaginal cells.
- Flat angular borders without a nucleus.
- Die due to thick vaginal lining, movement away from blood supply. Metestrus cells
- Seen in diestrus or bitch with vaginitis, rarely in early proestrus
- Parabasal/intermediate cells which appear to contain one or more neutrophils in cytoplasm.

Foam cells

- Very rare, usually associated with diestrus and anestrus.
- Parabasal & intermediate cells with cytoplasmic vacuoles.

Other Cells

- Include RBC, neutrophils, bacterial cells.



PARABASAL CELLS

Healthiest and smallest of vaginal cells. Round or slightly oval with large vesiculated nucleus and relatively small amount of cytoplasm.

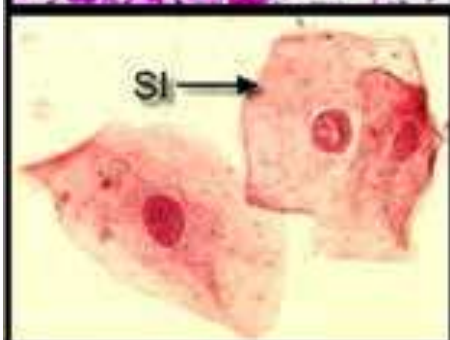
PB - Parabasal
N - Neutrophil



INTERMEDIATE CELLS

Vary in size from slightly larger than parabasal cells to twice their size. Cells have a smooth, oval to rounded irregular borders, vesiculated nucleus which is smaller than those found in parabasal cells. Change in cell morphology reflects the first stage in cell death. Cells can be classified as small intermediates and large intermediates.

I - Intermediate
N - Neutrophil



SUPERFICIAL INTERMEDIATE CELLS

Cells have angular, sharp, flat cytoplasmic borders typical of superficial cells but the nucleus is still vesiculated.

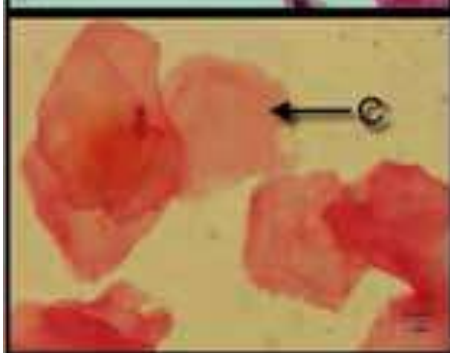
SI - Superficial
Intermediate



SUPERFICIAL CELLS

Largest cells identified in vaginal cytology. Cells have sharp, flat, angular cytoplasmic borders and small pyknotic, fading or ghost nuclei.

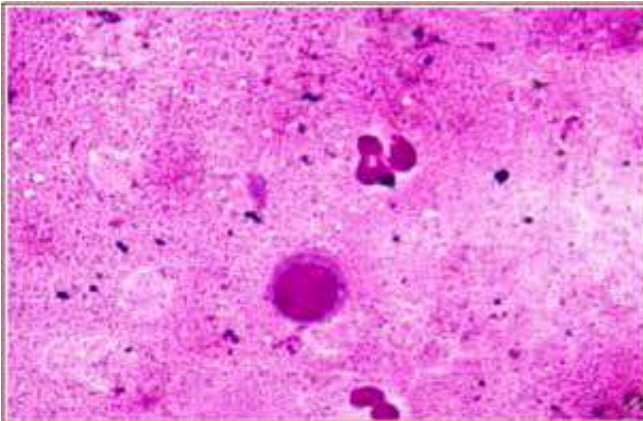
S - Superficial



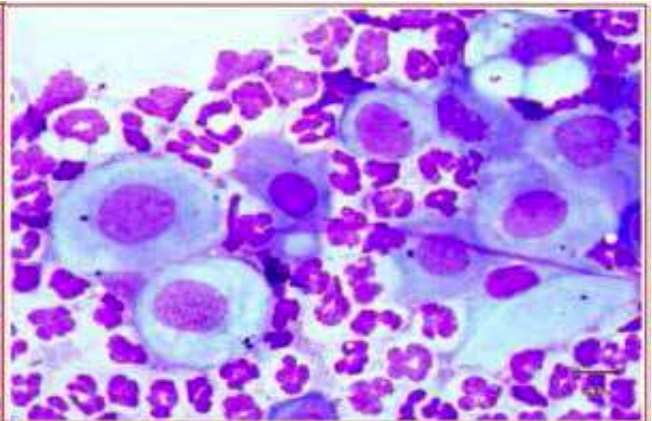
CORNIFIED CELLS

Cornified cells are large, dead irregular vaginal cells with no nucleus. These cells represent the end of process that began with healthy round parabasal cells. These cells are also called as anuclear superficial cells, fully keratinized or fully cornified cells.

C - Cornified



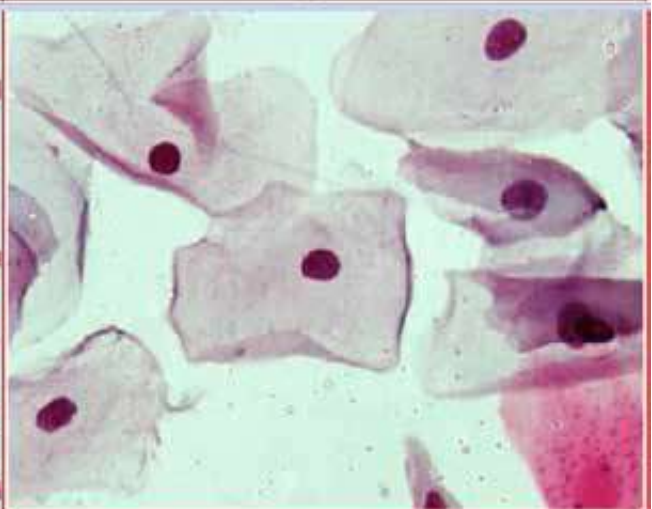
Vaginal cytology at 100 X showing parabasal cells and neutrophil-Stage Anestrus



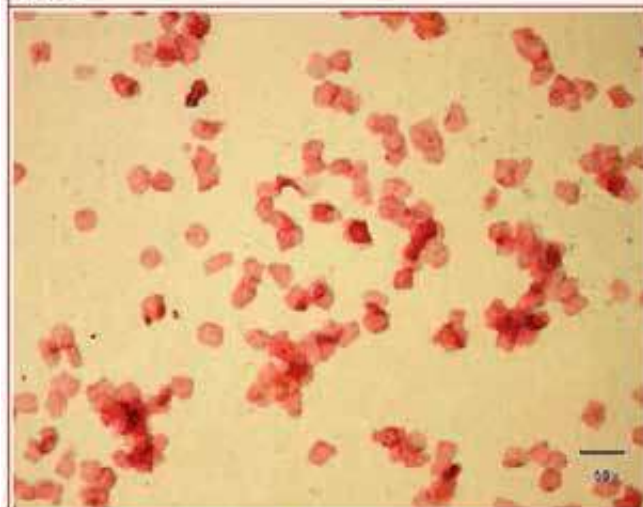
Vaginal cytology at 100 X showing large intermediate cells and plenty of neutrophils-Stage Diestrus with vaginitis



Vaginal cytology at 10 X showing superficial cells Stage Estrus



Vaginal cytology at 100 X showing superficial cells Stage Estrus



Vaginal cytology at 10 X showing cornified cells. Stage Estrus



Vaginal cytology at 100 X showing cornified cells. Stage Estrus

Early Proestrus

- RBC in abundance
- Numerous parabasal and small intermediate cells
- Neutrophils are common not abundant.
- Bacteria may be in small or large numbers.
- Slide background dirty due to viscous cervical-vaginal secretions.

Mid Proestrus

- RBC may or may not be present.
- Parabasal and small intermediate cells decreasing.
- Replaced by large intermediate and superficial-intermediate cells.
- No neutrophils, background dirty or clear.

Late Proestrus

- RBC variable numbers.
- 80% are superficial cells and keratinized cells.
- No neutrophils, background clear.

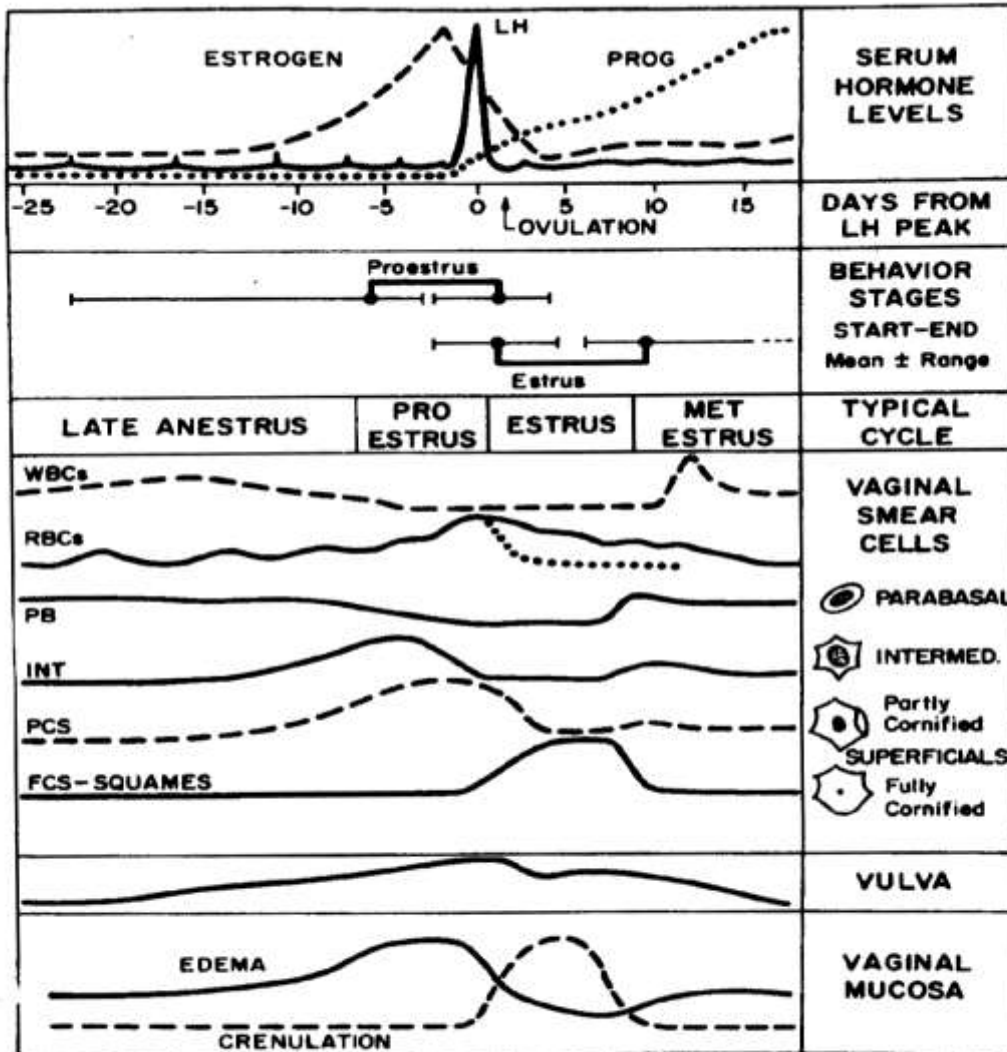
Estrus

- RBC may or may not be present.
- Superficial and keratinized cells account for 80-100% cells.
- Day of standing heat – keratinized cells > 90% of total cells.
- No neutrophils.
- Background clear.

Diestrus

- Superficial cells <20%, remainder are intermediate cells.
- Neutrophils reappear.

- Background contains lot of debris.
- Metestrus and foam cells may be seen



Schematic summary of temporal relations among periovulatory endocrine events, behavioral and vulval changes, and general changes in vaginal exfoliate cytology associated with proestrus and estrus in the bitch.

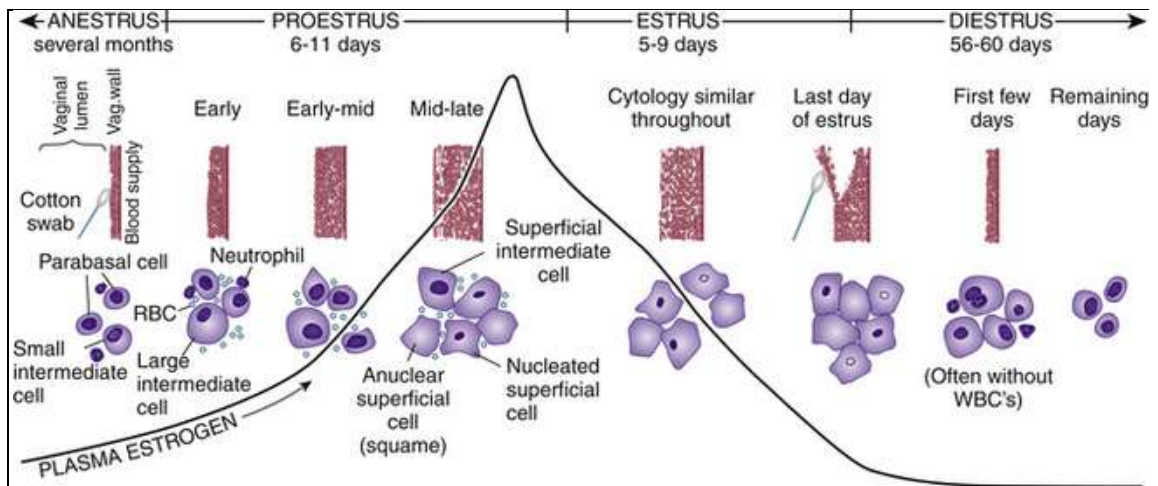
Anestrus

- RBC absent, primarily parabasal and small intermediate cells.
- Neutrophils may be present or absent.
- Bacteria may be present (normal flora).
- Background may clear or bit dirty.

Inference

- Shift to left – More number of parabasal – “Atrophic effect” –Anestrus.

- Shift to middle - More number of intermediate cells –“Progesterone effect” – Diestrus/ Persistent CL
- Shift to right - More number of superficial and cornified cells –“Estrogenic effect” – Estrus/ cystic ovary.



Vaginal cytology during different phases of oestrus cycle in bitch

EXERCISE

1. Perform the vaginal cytology and draw the observations

Signature

Practical No. 5

COLLECTION AND EXAMINATION OF CERVICO-VAGINAL MUCUS FOR DETECTION OF OESTRUS IN CATTLE

Objectives:

1. To diagnose proper stage of oestrus for artificial insemination.
2. To study the physical characteristics of cervico-vaginal mucus so as to differentiate the abnormal genital discharges.

Materials required:

1. Collecting catheter (glass or plastic)
2. Plastic syringe (5 ml or 10 ml)
3. Rubber adapter
4. Glass slides
5. Microscope
6. Screw-cap glass vial
7. Filter paper
8. Soap
9. Cotton
10. Glass rod
11. Measuring scale
12. Water

Procedure of collection of mucus by recto-vaginal method:

1. Restrain the animal in a chute or service crate properly.
2. Wash and clean the perineum and vulva thoroughly with soap and water, then dry the area by mopping with cotton
3. Fix the cervix per rectum with a lubricated hand
4. Direct the sterilized collecting catheter tilted with a syringe aseptically through the vulva and vagina to the cervix with the other hand
5. Collect the cervico-vaginal mucus from the external os and fornix vagina by aspirating into the catheter with the help of the syringe
6. Transfer the mucus to a screw capped glass vial.

Physical characteristics:

- a.** Examine the mucus for volume (free flowing, medium, scanty), colour (clear/transparent, translucent or turbid/ dirty) and consistency (thin or thick).
- b.** Observation of fern pattern (arborization or crystallization pattern)
 1. Immediately after collection spread the mucus uniformly over a sterilized clean dry glass slide, with the help of a glass rod.
 2. Allow the smears to dry completely in air at room temperature and examine under low power microscope for the appearance and type of crystallization pattern of mucus called fern pattern.

Fern pattern is:

- A.** Typical: The arborization type exhibits a true fern leaf like appearance. Fern patterns are visible throughout the smear, with tertiary to quaternary or quinquennial branching, which are well marked with bright and thick boundaries.
 - B.** Atypical: The arborization type does not exhibit a true fern leaf like appearance. Fern patterns are scattered, small and branching or fern branches become dismal and discontinuous and are not well cut out into further branching.
 - C.** No pattern: When fern pattern is absent.
-
- c.** Spinnbarkeit Test (Elasticity): The elasticity of the oestral mucus is measured by Spinnbarkeit test.
 - a. Place about 0.5 ml of mucus on a glass slide wrapped in filter paper.
 - b. Another slide, wrapped similarly is placed over the mucus on the slide.
 - c. Draw the two slides apart vertically so that a mucus thread is formed.
 - d. Maximum length of unbroken mucus thread so formed in between the two slides is measured with the help of the measuring scale and recorded as spinnbarkeit value in cm.

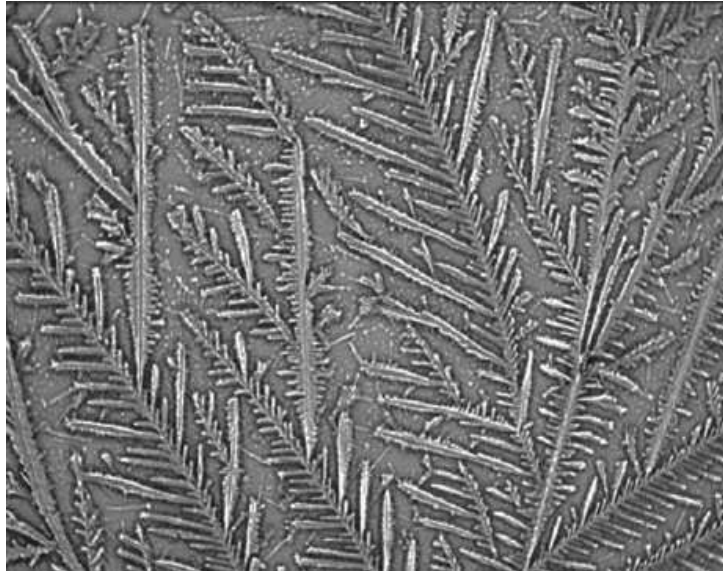


Figure 1. Typical morphology of bovine cervical mucus at oestrus observed under light microscopy (200X). An arborescent crystalline pattern resembling a fern frond can be observed

EXERCISE

1. Write down the physical and fern pattern characteristics of cervical mucus.

1. Physical characteristics:

Colour: Clear/Transparent

Translucent: Imperfectly transparent, shining

Turbid/Dirty: Not homogenous in look, dirty colour like yellow, grey, red or sometimes mixed

Consistency: Thin: Mucus can flow on glass slide kept at 45° angle

Thick: Sticky mucus on glass slide and do not flow at 45° angle.

2. Fern pattern

Type

Diagram

Signature

Practical No. 6

Collection and transportation of material from the herd with reproductive infections

Objectives

- Collection of infected materials with suitable method.
- Timely transportation of material in suitable media for isolation and
- identification of aerobic/anaerobic bacteria and viruses.
- In-vitro drug sensitivity.
- Histopathology.

Material required for the diagnosis of disease causing abortion in bovines			
Disease	Organism	Stage of gestation	Samples needed
Leptospirosis	Bacteria (5 serotypes)	Any stage; usually 6 - 9 months	Fetus, placenta, blood samples from aborting and other cows in a herd
Brucellosis	Bacteria (B. abortus & malitensis)	6 - 9 Months	Fetus, placenta, blood sample, Fetal stomach contents
IBR	Viral	6 - 9 Months	Fetus, placenta, blood sample
BVD	Viral	Variable; usually early	Two blood samples; 3 wks apart, fetus
Trichomoniasis	Protozoal	2 - 4 Months	Preputial scraping / washings from infected bulls, uterus from culled cow, aborted fetal tissue (lungs, spleen)
Listeriosis	Bacterial	Variable	Fetus, placenta, blood sample
Campylobacteriosis (Vibriosis)	Bacterial (C. fetus venerealis)	Early abortions	Vaginal mucus, cervical mucus tampons, preputial washing of infected bulls
	C. fetus intestinalis	+/- 6 Months	Fetus
Chlamydial abortions	C. Psittaci	Variable	Fetus, placenta
Mycotic abortion	Fungal (Aspergillus & others sp.)	6 - 9 Months	Fetus, placenta

Collection of uterine swab

- For isolation, identification and drug sensitivity test.

Requirement

- Sterilized Nielsen's uterine swab catheter, spirit, cotton, soap, water.

Procedure

- Restrain the animal properly and evacuate the rectum by backraking.
- Wash and clean the perineum and vulva thoroughly with soap and water and mop it. Lastly, clean with rectified spirit.
- Fix the cervix per rectally using one hand and introduce sterilized catheter into the vagina with other hand and pass through cervix into the uterine body.
- Expose the swab by pushing the plunger and then rotate it. Close the catheter by pulling the plunger outward.
- Take out swab catheter; transfer it to lab for further processing.
- Protect sample from sunlight, high temperature during transportation.

Collection of uterine biopsy

- To study histopathology and histochemistry.

Requirement

- Nielsen's uterine biopsy catheter / punch, spirit, cotton, soap, water

Procedure

- 1, 2 & 3—same as above
- For biopsy catheter—expose the groove of inert tube by pushing it and press the uterus per rectally, so that a portion of endometrium is fixed into groove of catheter and then pull inert tube outward. Single jerk given to outer tube (trochar) cuts a piece of endometrium.
- For biopsy punch—open the jaws of the punch and push a portion of endometrium between the jaws by pressing the uterus per rectally. Close the jaws firmly and rotate it.
- Take out the biopsy punch / catheter and transfer the tissue in processing media depending upon its further investigations.

Transportation of material associated with aerobic/anaerobic infections

- Transport on ice in transport medium like Cary Blair, Stuart's, Amies.
- Special transport medium containing antibiotics for isolation of campylobacter from preputial washings.

Transportation of biopsy material

- For bacterial examination – nutrient broth,
- For histopathology – buffered neutral formaline
- For histochemistry – Specific media

EXERCISE

- 1. Perform the collection of cervico-vaginal mucus of the farm animal and write down its physical characteristics**

Signature

Practical No. 7

STUDY OF GYNAECOLOGICAL INSTRUMENTS AND APPLIANCES

- a. **Vaginal speculum** (Polsson pattern): It is made of stainless steel consisting of a pair of long beaks and a handle for opening and closing of the speculum. It is available in various sizes
- a) Large (14" long)- for cows and buffaloes
 - b) Medium (8" long)- for heifers
 - c) Small (6" long) for sheep, goat and bitch.

It is used for examination of the vagina, the external os of the cervix and also for applying medicines into the parts of the female genitalia. In small animals like sheep and goat it is used for performing artificial insemination. The external genitalia and the perineal region have to be thoroughly cleaned with a disinfectant solution. Care must be taken so that the speculum is cleaned, sterilized and lubricated before use. The beak of the speculum is lubricated with a sterile lubricant and inserted into the vagina with exertion of slight pressure while the speculum is rotated. The speculum might first have to be directed upward in order to pass over the ischiatic arch. Then with the help of the handle the beak is opened to locate the desired part of the genital organ through the opening.

- b. **Obel's apparatus**: It is used to irrigate/ infuse the uterus with liquid medicine like Lugol's iodine. This apparatus consists of one graduated glass bottle along with a delivery tube connected to a rubber pipe and another rubber pipe connected to a hand rubber blower. With the help of the rubber blower air pressure is created inside the bottle which helps the out flow of liquid medicine through the delivery tube connected with a uterine catheter into the female genital organ.
- c. **Swab holder**: It is a long metallic rod having a provision to hold a swab. It is commonly used to apply medicines into the external os cervix or any part of the vagina. It is also used to collect materials aseptically with a swab from the vagina or os cervix for bacteriological analysis. The vagina is opened with the help of a vaginal speculum and the swab holder is introduced through the opening and directed into the desired/affected part for application of medicines or for collection of swab.

- d. **Polypus/tamponing forceps:** It is a long metallic forceps generally used to collect materials for examination from the anterior vagina, os cervix etc. It may also be used to stop bleeding in the vagina.
- e. **Douch can:** It is made of enamel having a provision for outlet at the bottom where a rubber tube is connected. It is very commonly used for infusion of large volume of liquid medicine/antiseptic solution into female genital organ for flushing or washing in cases of pyometra, prolapse of uterus and cervix etc. The rubber tube can be directly introduced into the uterus or can be connected to a catheter where introduction of rubber tube is not possible. It is also used to put enema.
- f. **Bane pattern two way bivalve metal uterine catheters with cervical block:** It is used for flushing/washing of the uterus with liquid medicine. Through the upper valve the liquid medicine is infused into the uterus and through the lower valve the flushing material can be evacuated or drawn out.
- g. **Folmer Nielson metal uterine catheter:** It is used for infusion of liquid medicine into the uterus. The catheter is introduced into the uterus and its outer end can be connected with the outlet of Obel's apparatus, Douch can or a large syringe to run the solution into the uterus.
- h. **Glass catheter with rubber adapter and plastic syringe:** It is commonly used for doing artificial insemination with liquid semen. The semen is drawn into the catheter with the help of plastic syringe which is connected to the catheter with a rubber adapter. The catheter is introduced into the cervix and semen is deposited in the desired site. The glass catheter can also be used for infusion of liquid medicine into the female genital organ. The catheter must be cleaned and sterilized before its use.
- i. **Metallic container for catheters:** It is used to keep the catheters after they are cleaned and sterilized to prevent contamination. This should also be used for carrying sterilized catheters to a distant place for A.I. or any purpose of treatment. The container should be periodically cleaned and sterilized.
- j. **Plastic/Gynaecological apron:** It is used as protective clothing while examining the animal. It helps to prevent soiling of clothes with faecal material full sleeves rubber hand gloves: It is an essential item not only for sanitary and aesthetic reasons but also for protection. It is worn by the operator during rectalexamination or palpation so as to

prevent infection to the operator or to the animal. Without this the rectum may be injured during palpation of the genital organ.

k. Vaginoscope: There are two types of vaginoscopes, namely

- a) Plastic vaginoscope: With provision of light.
- b) Cold lite vaginoscope: Vaginal examination is seldom employed routinely. It is indicated only in certain. Sterilization between examinations makes routine use impractical. When indicated, detailed examination of the external os of the cervix, the vaginal and vestibular mucosa and the suburethral diverticulum can be performed. Moreover it can also be used for administration of medicine to the vaginal wall and the external os of cervix. The transparent vaginoscope with provision of light makes examination of the entire canal easier without any obstruction.



Vaginoscope

EXERCISE

1. Draw the diagram of gynaecological instruments available in clinics

Signature

Practical No. 8

PREPARATION OF LUGOL'S SOLUTION FOR INTRA UTERINE INFUSION

Lugol's solution is commonly used for

- i) Intra-uterine irrigation in the treatment of repeat breeding, endometritis etc. – 0.25% solution.
- ii) Painting the os cervix in the treatment of anoestrus etc and sometimes endometritis 5% solution

Generally, in gynaecological practice a 5% stock solution is prepared. For intra-uterine irrigation Lugol's stock solution should be diluted 20 times making it a 0.25% solution.

Preparation of stock Lugol's solution (100 ml)

Composition

Iodine: 5g
Potassium Iodide: 10 g
Distilled water upto: 100 ml

Procedure:

- b. Take potassium iodide, add iodine to it, mix thoroughly and then add distilled water upto 100 ml. This solution should be properly filtered before use.
- c. Preparation of working solution: The amount of stock solution to be added to distilled water for obtaining a desired volume of working solution can be determined using the following formula.

$$\text{Vol. of stock solution required} = \frac{\% \text{ of working solution desired}}{\% \text{ of stock solution}} \times \text{Total vol of working soln. required(ml)}$$

- d. Add required amount of distilled water to the stock solution required to obtain total volume of desired working solution.

The above formula may be simplified as described below:

$$\text{Volume of stock solution required} = \frac{0.25}{5} \times \text{total volume of working solution}$$

EXERCISE

- 1. Prepare the 0.25% OF Lugol's solution**

Signature

Practical No. 9

INTRAUTERINE INFUSION OF DRUGS

Objectives: Intrauterine therapy is employed to treat uterine infections

Equipments needed:

1. Bivalve metal uterine catheter
2. Folmer Nielson metal uterine catheter
3. Plastic insemination pipette
4. Glass insemination pipette
5. Plastic syringe (50 ml)
6. Adapter
7. Pressure infusion set (Obel' s apparatus)
8. Gravity infusion set

Antibiotics and certain disinfectants are used in aqueous solutions for overcoming uterine infections. These can be infused into the uterus of cattle by gravity through instruments with relatively small bores. Larger bore-instruments and pressure infusion apparatus facilitate deposition of suspensions or emulsion in oil.

The amount of fluid to be infused will be according to the size of the uterus. Excessive amounts might elicit uterine contractions resulting in rapid expulsion of the solution. If it is infused in insufficient amounts, the active substance might not gain contact with the entire endometrium.

Some of the failures of intrauterine therapy might be due to the use of too small amount of solution, or due to the failure to place the solution in both horns of the uterus.



Uterine Catheter

EXERCISE

- 1. Write down the indications of intrauterine infusion**

Signature

Practical No. 10
PREGNANCY DIAGNOSIS IN FARM ANIMALS BY
CLINICAL EXAMINATION

Objectives:

1. To identify non-pregnant animals after mating or insemination so that production time lost as a result of infertility may be reduced by appropriate treatment or culling.
2. To certify animals for sale or insurance purposes and
3. To help in economic management of animal production

Materials required:

1. Obstetrical rubber arm sleeve with attached hand glove
2. Non irritating lubricant

Procedure: The animals brought to the clinics for pregnancy diagnosis will be subjected to rectal examination/ abdominal palpation or ballottement as is the method of choice for the particular species. Moreover, pregnancy diagnosis in cows by rectal examination will be carried out at Instructional Livestock Farm, Apollo College of Veterinary medicine, Jaipur.

RECTAL EXAMINATION

Bovine: Pregnancy diagnosis is based upon detection of the physiological changes of the genital Organs associated with pregnancy The uterus, being the organ primarily involved, deserves major consideration Per-rectum examination of uterus and its contents is the method of choice for pregnancy diagnosis in the cow The general changes include the following

- A. Size increase:** Increase in size of the uterus, particularly of the pregnant horn, produce asymmetry of the uterine horns.
- B. Fluctuation:** The increase of horn size is associated with formation and accumulation of foetal fluids and on palpation, the presence of fluid gives a feeling of fluctuation.
- C. Position of the uterus:** Because of the gradually increasing weight of the organ, there is a change in the position of the uterus. A displacement of the greater curvature of the

horn, often laterally, is the first noticed change in position. This is soon followed by descent ventrally which commences at about the 75 day of pregnancy and is completed at approximately the 130th to 140th day. The ascent begins at 7 to 7 ½ months of the gestation.

- D. The foetal membranes:** The foetal membranes are clinically recognized during rectal palpation as the amniotic vesicle, the cotyledons and the so-called foetal membrane slip. The foetal membrane slip is the chorioallantois which is detected by compression of the pregnant horn and letting it slip between the fingers. The fold of the chorioallantois slips through just before the upper fold of the wall of the uterus.
- E. The conceptus:** When the conceptus has reached a certain age, it can be detected by palpation of the contents of the pregnant uterus. This time coincides with the period when the amniotic vesicle begins to lose its turgidity. At first it can be felt and grasped directly. During the period between descent and ascent, the foetus is palpated by ballottement.
- F. Hypertrophy of the middle uterine arteries:** Hypertrophy is found particularly in the middle uterine artery supplying the pregnant horn and from the 75 to 80 days of pregnancy, fremitus or "buzz" accompanies every pulse wave.
- G. The corpus luteum:** Fertilization is followed by persistence of the corpus luteum and it is almost always located in the ovary on the same side as the pregnant horn.

It is extremely important, however, to be aware that certain of these clinically detectable palpable signs alone do not represent positive evidence of pregnancy. There are certain pathological conditions which are associated with similar identical findings. The only positive signs of pregnancy are the foetal membrane slip, amniotic vesicle, the cotyledons and the foetus. The finding of any one of these signs is generally sufficient for diagnosis of pregnancy.

ABDOMINAL PALPATION

Bitch: With the bitch in standing position, grasp the abdomen gently as if holding a football by applying steady pressure up towards the spine and then gently bringing the

fingers together, allowing the abdominal viscera to 'slip through the fingers, one can, with practice , locate the pregnant uterus and estimate the stage of pregnancy.

During the first 18 days of pregnancy only minor gross changes occur in the uterus. By day 28th, the uterine enlargement changes to ovoid shape and increase in size to 15-30 mm in diameter depending on the size of the bitch. Optimal period of early diagnosis is by day 33. By this time embryonic unit maintain spherical form. By day 40, the uterus comes in contact with abdominal wall and in animal pregnant with multiple foetuses abdominal distension becomes visible. By day 45, it may be possible to detect the posterior situated foetus between fingers. After day 55, there should be no difficulty in diagnosing pregnancy provided the bitch allows manipulation of abdomen.

Digital palpation of the pregnant uterus can, of course, be complicated by tense, fat or large bitch and by a long gastrointestinal tract or bladder. Another complication to positive pregnancy diagnosis is presence of segmentation of uterus in pseudo pregnancy.

BALOTTEMENT AND SUBJECTIVE EXTERNAL EXAMINATION

Goat/ Sheep: It is shown to be 80-95 percent accurate at 90-130 of pregnancy and the accuracy increases with increasing gestational age. It is advantageous to withhold feed and water 24 hours before diagnosis. The ewe/doe is held in sitting position approximately 2 feet above ground level by an assistant. With one hand pressed against left side of ewe's/doe's abdomen, the operator ballot the lower abdominal area with finger tips of other hand Technique is simple and fast but number of foetuses cannot be determined accurately.

RADIOGRAPHY

It is based on the identification of the foetal skeleton on an X-ray plate.

Goat/Sheep:By 80 days gestation the foetal skeleton is well calcified, making the radiological diagnosis of pregnancy and foetal numbers relatively simple and accurate.

Bitch: A single radiograph in dorsoventral view may be useful to identify more accurately foetal numbers and foetal presentation. In interpreting radiographs three points required identification, firstly, displacement of the intestinal mass by the early gravid uterus,second,

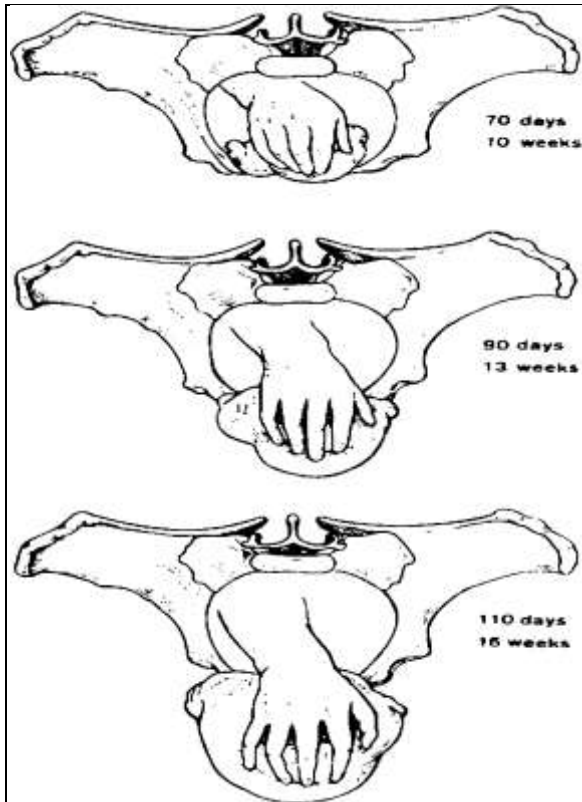
identification of uterus, and thirdly, the presence of foetal skeletons. It is possible to see foetal sacs at 23-25 days of gestation. At the end of 6 weeks there may be evidence of foetal skeletons; with the skulls identifiable by 45 days. At the end of seven weeks it is normally possible to identify the whole foetal skeleton. Radiography is probably most valuable in identifying the pregnancy in large or fat animals with one or two foetuses and in differential diagnosis of pseudo pregnancy.

PALPABLE CHARACTERISTICS APPEARING AT CERTAIN STAGES OF PREGNANCY IN THE COW

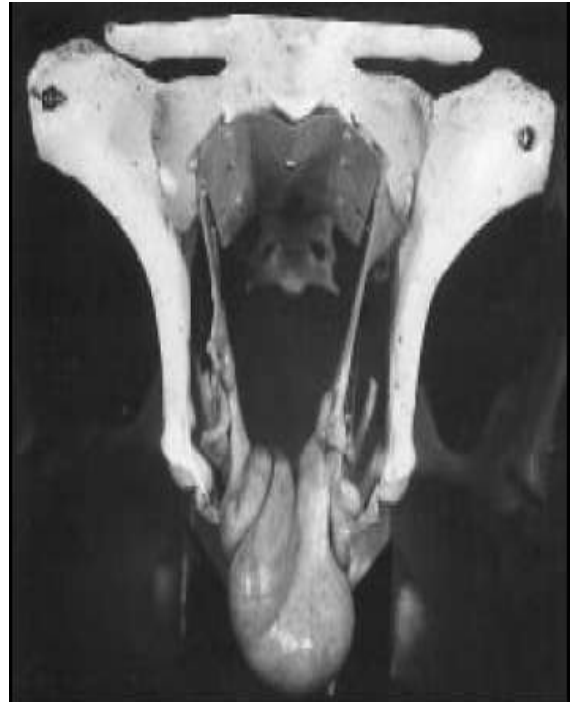
Stage of pregnancy		Size and position of gravid uterus	Cotyledons	Foetal membrane slip	Fremitus/uterine artery	Uterine character	Remarks
Month 1	4 weeks	Slight enlargement	Not appreciable	Hard to perceive	-	Soft walled but has tone	Diagnosis at this stage is compounded by subsequent embryonic death
2	5 weeks	3 cm in diameter				Significantly soft walled readily allowing portion to be pinched for 'slip' test.	The non- gravid horn tapers more than the gravid horn. Vesicle 1.5 cm. pregnant horn becomes enlarged arched tubular.
	6 weeks	5 cm in diameter (gravid horn comparably larger)					Vesicle 6.0 cm A 'Puffy collar' develops at junction of cervix and body of uterus.
	7 weeks	7 cm in diameter (gravid horn about twice size of non gravid horn) Intrapelvic (except					Damage to CL and other local trauma can cause abortion in early stage of pregnancy. Vesicle 6.0 cm A 'Puffy collar' develops at junction of cervix and body of uterus.

	8 weeks	in older stock) 9 cm in diameter about brim of pelvis		Slip detectable May slip in both horns	Uterine artery becoming thicker	-	Embryo golf ball in size
3	11 weeks 13 weeks	14 cm in diameter extending over brim of pelvis 16 cm in diameter descending intra-abdominale	1 cm Small (1.5 cm)	Can be slipped in both horns Can be slipped in both horns	Fremitus may be just detectable in a few cases at this early stages Fremitus may be detectable artery becomes thicker	Enlarged curved, tubular later becoming a tense bladder like viscous	In heifer the gravid horn clears the pelvic brim typically at this stage. Foetus apple sized and palpable.

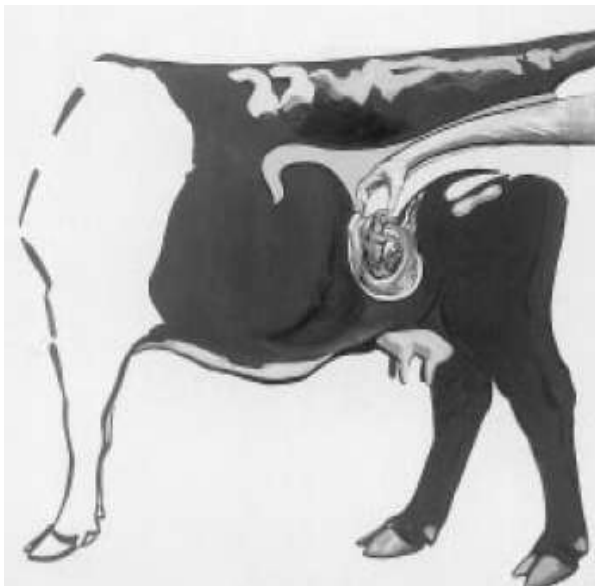
4	17 weeks	Descending intra-abdominally hanging over pelvic brim	Palpable (walnut sized)	Can be slipped in both horns	Fremitus detectable on gravid side in most cases. Artery still increasing in caliber	Dorsal aspect bouncy with lumpy areas (cotyledons or embryo)	Cervix drawn over brim of pelvis as a flattened tough band.



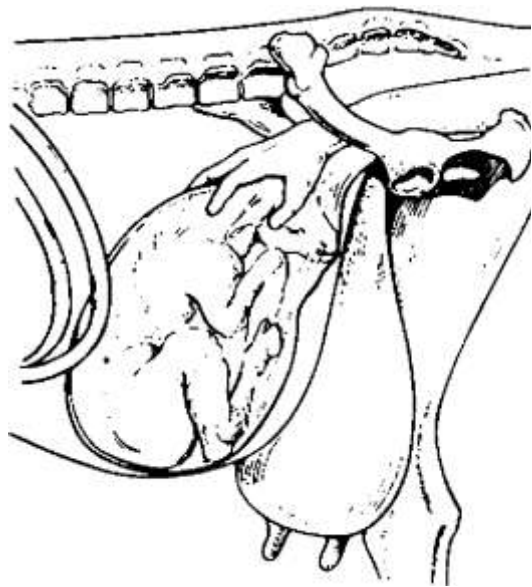
Sixty days of pregnancy uterus may hang over pelvic brim



Position of 90 days fetus



Advanced stage of pregnancy



PALPABLE CHARACTERISTICS APPEARING AT CERTAIN STAGES OF PREGNANCY IN THE COW

Stage of pregnancy	Size and position of gravid uterus	Cotyledons	Fremitus/ uterine artery	Uterine character	Remarks
5 month	On abdominal floor becoming more difficult to reach	Distinctively palpable if in reach	Artery about pencil thickness fremitus becomes more pronounced (pulse acquires a more positive buzzing character)	Dorsal aspect less tense and present buoyant surface with lumpy areas (cotyledons)	Fremitus marked from this stage onwards on gravid side
6	On abdominal floor and ascending (filling up)	Palpable	Artery prominent. Fremitus marked as vibrating pulse	Sometimes difficult to reach	May not be possible to palpate cotyledons. The suspension of the rectum and reach of operator determine the extent to which the ventrally drawn organ can be examined.
7	Ascending towards pelvic inlet	5 cm	Artery finger thickness fremitus acquires a gushing character	Extensive viscus with occasional foetal contact	Foetus half grown and parts bump against hand in deep rectal palpation. Foetus can usually be balloted deep in the ventral right flank.
8	Ascending above pelvic brim	6 cm readily palpable	Fremitus may be present on non-gravid side also but to lesser degree	Uterine wall thick, less tense and enclosing bony foetus	Foetus can be balloted against lower right flank at this stage and beyond. Well grown and readily palpable. Parts e.g. head, limbs readily identifiable at

					pelvic inlet.
9	Ascending above pelvic brim	8 cm readily palpable	Fremitus has a continuous flowing character and ceases immediately after parturition	Uterine wall thick, less tense and enclosing bony foetus	Large foetal parts palpable within the pelvis. Foetus can be readily balloted in mid right flank. External evidence of imminent parturition allows the period in gestation to be pin pointed

EXERCISE

- 1. Perform pregnancy diagnosis in farm animals and write down the observations**

Signature

Practical No. 11

Demonstration of ultrasonographic imaging of reproductive organ and pregnancy

Ultrasound is a high frequency sound wave. Sounds audible to the human ear vary between 20 to 20,000 Hertz (Hz) (Cycles per second) while ultrasound waves are of frequency higher than this, and for most diagnostic applications frequencies of 1-10 MHz are used. Ultrasound cannot be propagated in vacuum and in gas, transmission is poor. Reflection of ultrasound occurs between substances of different acoustic impedance (defined as the product of the velocity of sound in a substance and the density of the substance). Even the short distance between the transducer (which emits and receives ultrasound signals) and the patient must be bridged by a suitable coupling gel.

Basic principle

The ultrasound equipment basically consists of a transducer and a scan converter. The transducer is the ultrasound producing part. It is fitted with a piezoelectric crystal (Lead – zirconate – titanate or others) which when stimulated by a high voltage current emits the ultrasound. The ultrasound is transmitted to the patient from the transducer and propagates through the tissues. The ultrasound beam is either reflected back, partially absorbed or entirely absorbed. The returning beam (echoes) meets back and deforms the crystals in the transducer. This mechanical energy is converted back to an electrical signal proportional to the strength of the echo and delayed by a time roughly proportional to the distance traveled. The scan converter interprets the variations in brightness displayed on the cathode ray tube of a B-mode system (or as a variation in amplitude in A-mode oscilloscope screen) and also stores images when required. The ultrasound is emitted in a pulse – echo manner. A pulse of ultrasound is emitted and its reflection perceived prior to emission of the next pulse.

Types of instruments and some definitions

For most diagnostic veterinary purposes B-mode, real time ultrasonography is used employing different types of transducers. Transducers used commonly in veterinary reproductive practice are the linear transrectal transducer (frequencies of 5-10 MHz) and the sector transabdominal transducer (frequencies of 1-4.0 MHz). For most reproductive diagnostic work, linear array transrectal transducers are employed in cattle, buffaloes, mares and female camels. Small sized transrectal transducers are also used for early pregnancy diagnosis in small ruminants (sheep and goat).

For bitches mostly transabdominal sector transducers are useful for pregnancy diagnosis with frequencies from 2 to 4.0 MHz. The same transducers can be used for pregnancy diagnosis in sheep and goat beyond day 40 of gestation. However, in order to visualize an early pregnancy or the nonpregnant bitch uterus transducers of high frequency (5-7.5 or 10.0 MHz) are essential.

A few of the common terms related to ultrasonography are described below:-

Anechoic (sonolucent) A tissue failing to reflect the ultrasound beam produces no echoes (e.g. A fluid filled follicle) and appears black.

A- mode Amplitude modulation. A one-element (one dimensional) display with time (distance) on the horizontal axis.

B-Mode Brightness modulation. A compound A-mode scan with amplitude translated into a brightness scale. Location on the display is related to position and depth.

Doppler ultrasound When an ultrasound beam meets a moving object the reflected ultrasound is either of increased or decreased frequency, depending upon whether the motion is towards or away from the transducer.

Echogenic A structure causing a marked reflection of the ultrasound beam. A change in echogenicity in a homogeneous structure may indicate a pathological change.

Gain The amplification level of a returned signal.

Hyperechoic Showing increased echogenicity.

Hypoechoic Showing decreased echogenicity.

Transrectal ultrasonography

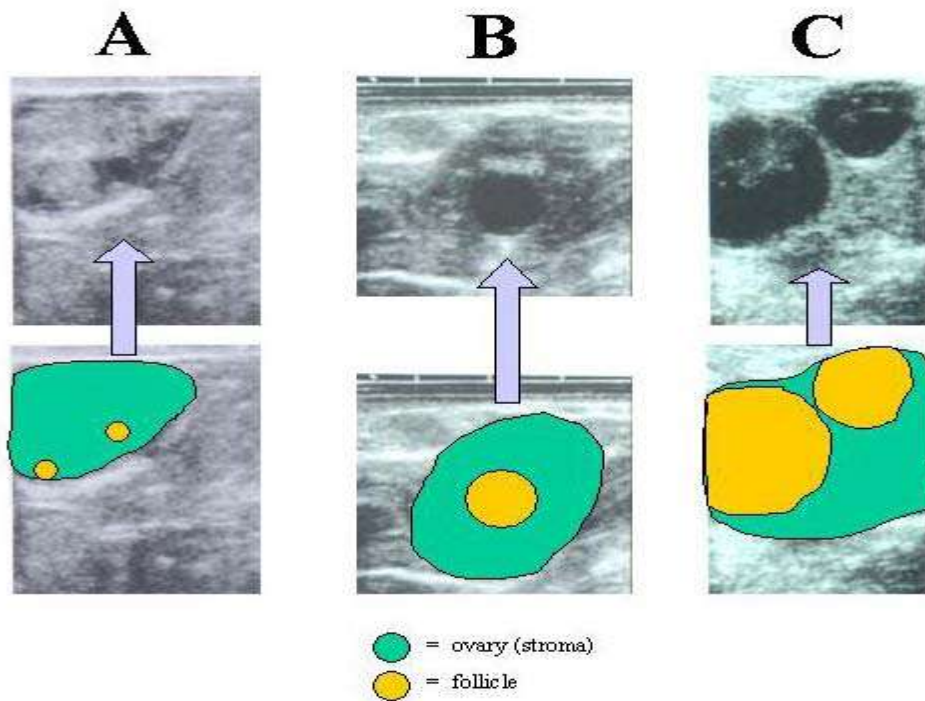
The animal to be examined is properly restrained, the feces are evacuated from the rectum and the perineum washed with water. The transducer is covered with a full arm sleeve with coupling gel put inside is used to cover the transducer. The operator keeps the transducer in his arm and takes it inside the rectum. The uterine horn on one side is scanned to the entire length and the ovary of that side is also scanned. The operator then moves his hand to the other uterine horn and ovaries. If the pregnancy is advanced the operator may have to take his hand deeper. When required the images seen may be frozen and the diameter of the structures measured by inbuilt calipers with the machine. The amount of fluid and thickness can also be measured.

Trans-abdominal (Transcutaneous) ultrasonography

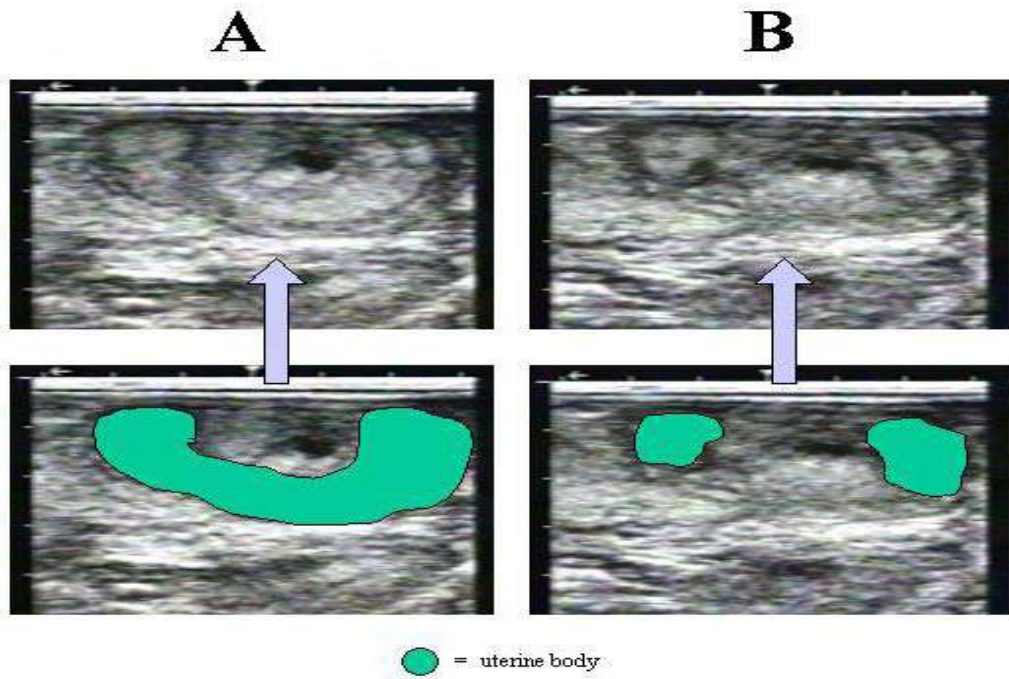
For reproductive trans-abdominal ultrasonography in sheep and goats the hair must be clipped from just above the udder and 15 to 20 cm ahead of the udder on both sides of the abdomen. The transducer is placed above the udder between the thigh and abdomen preferably the left side and moved in a 'W' shape from one side of the abdomen to the other side.

Sonographic findings

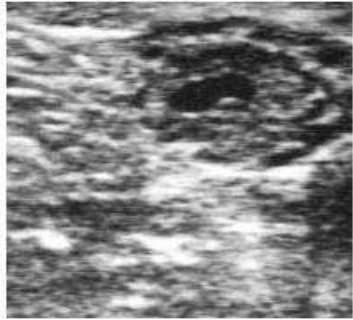
fluid filled structures appear black (anechoic), hard structures (like the bone) appear white (hyperechoic) and other structures with their structure midway between the bone and fluid appear grey (hypoechoic). The basic diagnosis of pregnancy lies in the identification of structures from black, grey or white scale.



Ultrasound image of bovine ovaries prior to emergence of a follicular wave (note two small follicles [< 5 mm]; Panel A), during proestrus (note preovulatory follicle [13 mm]; Panel B), and after development of a follicular cyst (note delamination of granulosa layer into the antrum; Panel C). Images were taken using a 7.5 Mhz transducer (Lamb, 2001).



Ultrasound image depicting an elongated (Panel A) and cross-sectional (Panel B) view of the non-pregnant uterus. Images were taken using a 5.0 Mhz transducer.



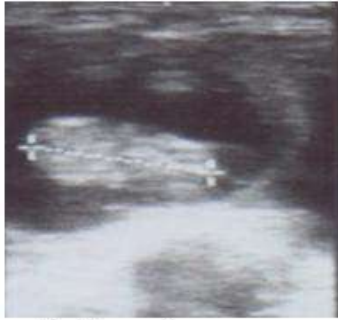
25 Day Pregnancy



30 Day Pregnancy



35 Day Pregnancy



43 Day Pregnancy

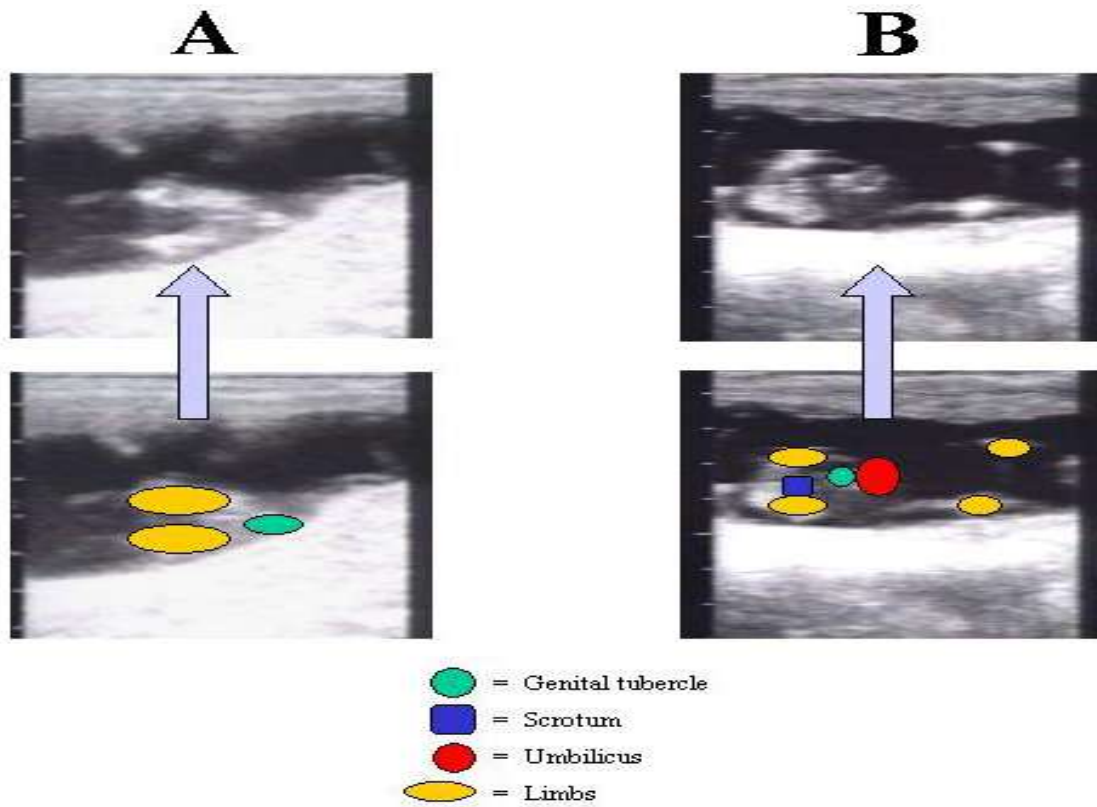


50 Day Pregnancy



100 Day Pregnancy

Ultrasound images of the bovine fetus at various stages of development.



Ultrasound image of a female bovine fetus (65days of gestation;Panel A) and a saggital view of a male fetus (65 days of gestation; Panel B). Images were taken using a 5.0 Mhz transducer.



Fig. 1.4: Transverse section through a uterine horn of a mare. The peritoneal borders are indicated by arrows. Analogous to the section represented by A in Fig. 1.5.

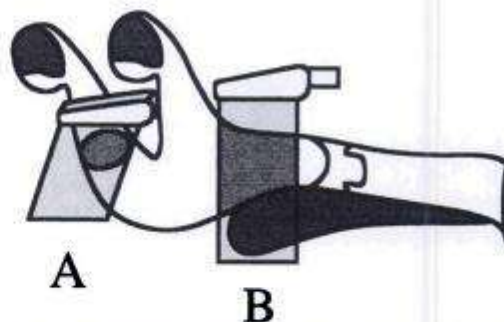


Fig. 1.5: Schematic presentation of a transverse section through a uterine horn (A) and a longitudinal section through the uterine body (B).



Fig. 1.6: Longitudinal section through the uterine body of a mare equivalent to the section illustrated by B in Fig. 1.5. The dorsal and ventral uterine borders are demarcated by large arrows. The opposing surfaces of the endometrium form an echoic line (small arrows).



Fig. 1.7: Transverse section through a uterine horn (arrows) of a nonpregnant mare. The uterus is positioned above 3 arched sacculations of the left dorsal colon. The difference in impedance between the intestinal wall and the feces cause total reflection of the ultrasound waves along the echoic sacculations of the colon.



Bovine corpus luteum (dense echoic part) and antral follicle (anechoic part)



Red arrow(Embryo Proper)
White arrow (Amniotic Sac)

Signature

Practical No. 12

OVARIO-HYSTERECTOMY AND PANHYSTERECTOMY

Ovariohysterectomy in the bitch is a surgical procedure consisting of laparotomy with ablation of both ovaries and the uterus.

SITE FOR OPERATION

- a) Flank region with an oblique angle parallel to last rib.
- b) Midline or linea alba

ANAESTHESIA

1. Premedication with sequil and then local anaesthesia.
2. Morphine or atropine (1/50 - 1/20 grain) may be given.

Premedication with Largectil and then inhalation by a mixture of alcohol, chloroform and ether in 1:2:1 ratio, respectively.

TECHNIQUE OF OPERATION:

It includes the following:

1. Securing the animal
2. Shaving and cleaning the site.
3. Anaesthesia
4. Equipments and instruments
5. Drugs
6. Post-operative care

Instruments:

Sterilized pack should contain following things:

1. Scissors straight and curved
2. B.P. Knife and blades
3. Dressing forceps
4. Artery forceps

5. Allis tissue forceps
6. Sterilized apron and towel
7. Syringe and hypodermic needle
8. IV set
9. Rubber sheet
10. Suturing needles and suture material
11. Antibiotics, saline, local anaesthetic drugs, Tincture iodine etc.

PROCEDURE

The surgical zone should be carefully scrubbed and disinfected using alcohol and surgical antiseptic solution several times over.

(a) Principal Phases

Laparotomy: The skin is incised along the linea alba starting from the umbilicus and ending a few centimetres in front of the pubis. Using a pair of scissors, the subcutaneous connective tissue, which may contain a substantial amount of fatty tissue, is bluntly dissected to visualise the linea alba. Haemostasis is performed before opening the abdominal cavity. If simple swabbing proves insufficient, any bleeders should be ligated or twisted to obtain a very clean surgical field.

Using rat-tooth forceps, the linea alba is grasped in the middle and tented up before being incised with a pair of scissors. The peritoneum is then punctured using a cannula that is slid towards the umbilicus to enable incision of the linea alba without damaging the abdominal contents, with the cutting edge of the blade turned uppermost. The same procedure is then performed in the opposite direction towards the pubis.

To find the uterine horns easily, the operating table is tilted so that the animal's head is below its feet, to move the abdominal organs towards the diaphragm. To locate the genital apparatus with ease, the bladder is retracted laterally; cranial to the bladder, the body of the uterus and bifurcation of the horns are easily locatable. One of the horns is then followed cranially up to the ovary, which is hidden in the fat-filled ovarian bursa. The ovary is not visible but can be felt through this ovarian bursa. It is a 1-2 cm long mass, which is exposed after incision of the bursa.

Sectioning the Ovarian Pedicle and Broad Ligament:

Ovarian Pedicle: The ovary is grasped and babcock forceps placed (fig A). The latter are handed to an assistant who holds the ovarian pedicle taught out of the abdomen to facilitate placement of a ligature as close as possible to the root of the pedicle to ensure haemostasis of the ovarian artery. The broad ligament is then punctured with a clamp to grasp the suture

material and a ligature is placed in the ovarian pedicle as close as possible to the lumbar wall (fig B). Once this ligature has been placed, the ends of the threads are kept long so that the ovarian pedicle can be found with ease in the event of haemorrhage. A clamp is then placed between this ligature and the ovary, and the pedicle is sectioned between the two (fig C). The ovarian pedicle is held throughout this procedure with a clamp. The quality of the haemostasis is checked; the long ends of the suture material on the ovarian pedicle are then cut. In some cases, such as in the event of hypertrophy of the vascular bundle, it may be advisable to place two ligatures, one around the artery and one around the ovarian vein (fig D, E, F). Never hold the ligature itself with the clamp, as it might slip off the pedicle when being released back into the abdomen.

Broad Ligament: If the broad ligament is seen to contain large vessels, they should be ligated prior to being cut (fig G). However, if the vessels are invisible and buried under fat, the ligament can simply be torn in the middle above the uterine artery by exerting traction between two swabs with the fingers to tear it from front to back to the level of the cervix, and as close as possible to the lumbar wall. A point of resistance will be encountered within the round ligament; this corresponds to the vaginal process which explains the risk of inguinal herniation of the uterus in bitches following relaxation of the latter.

Another technique for sectioning the broad ligament involves the placement of a row of overlapping mattress sutures along the length of the ligament before making the section with a scalpel or a pair of scissors. Once the ovarian pedicle has been sectioned, the second horn is located and the corresponding ovarian bursa grasped with Babcock forceps. The ovarian pedicle and broad ligament are sectioned as described previously. Finally, the two uterine horns are replaced back onto pelvis.

Suturing the anterior portion of the laparotomy incision: The prolapse of intestinal loops through the incision can cause significant heat and fluid loss, which can have very serious consequences, especially if the bitch is already suffering from deterioration in general status due to severe pyometra. It is therefore advisable to suture the anterior portion of the laparotomy wound before continuing the surgery. However, if the haemostasis of the ovarian pedicles or broad ligaments is a source of concern, the placement of a few forceps should suffice to provide temporary closure of the anterior portion of the laparotomy wound.

Sectioning the cervix:

Forceps placement: Once both of the ligatures have been placed (fig H), the cervix is crushed at their level with an intestinal clamp. Another clamp is then placed just above the first and the contents of the uterus are pushed back towards the horns; two other clamps are placed in the same way above the 2nd clamp. The 2nd and 3rd clamps are removed, thus leaving a secretion-free zone.

Ligating the uterine arteries and veins: Once both uterine horns have been flipped back onto the pelvis, the uterine cervix is sectioned, following ligation of the uterine arteries and veins (fig I, J). The veins can be visualised passing on either side of the cervix. The arteries run under the veins in the musculosa of the cervix, which is why the haemostatic sutures should transfix the lateral walls of the cervix. However, if the uterine artery is perforated during ligation, a wider transfixion is needed, more caudal to the previous attempt.

The musculosa is then sectioned cranial to the intestinal clamp placed on the cervix; if the clamp has been placed correctly, no fluid should leak from the cut ends.

Dealing with the stump:

Small, Normal cervix: The stump is simply replaced in the abdominal cavity. It is however advisable to suture it or bury it in a fold of omentum.

Pathological cervix: The cut section of the musculosa, mucosa, is cauterised with an iodine-based solution, and then sutured in two phases:

Suturing the abdominal wall: The sutured stump is returned to the abdominal cavity and the abdominal wall is closed using “X”-shaped interrupted sutures with Vicryl. If the subcutaneous connective tissue is very abundant, a simple continuous subcutaneous suture is performed using Vicryl. Finally, the skin is sutured using simple interrupted sutures or mattress sutures with non-resorbable filaments such as Monosin. The wound is then disinfected with antiseptic solution and protected with a few swabs and an adhesive dressing.

Procedure followed during Panhystrectomy

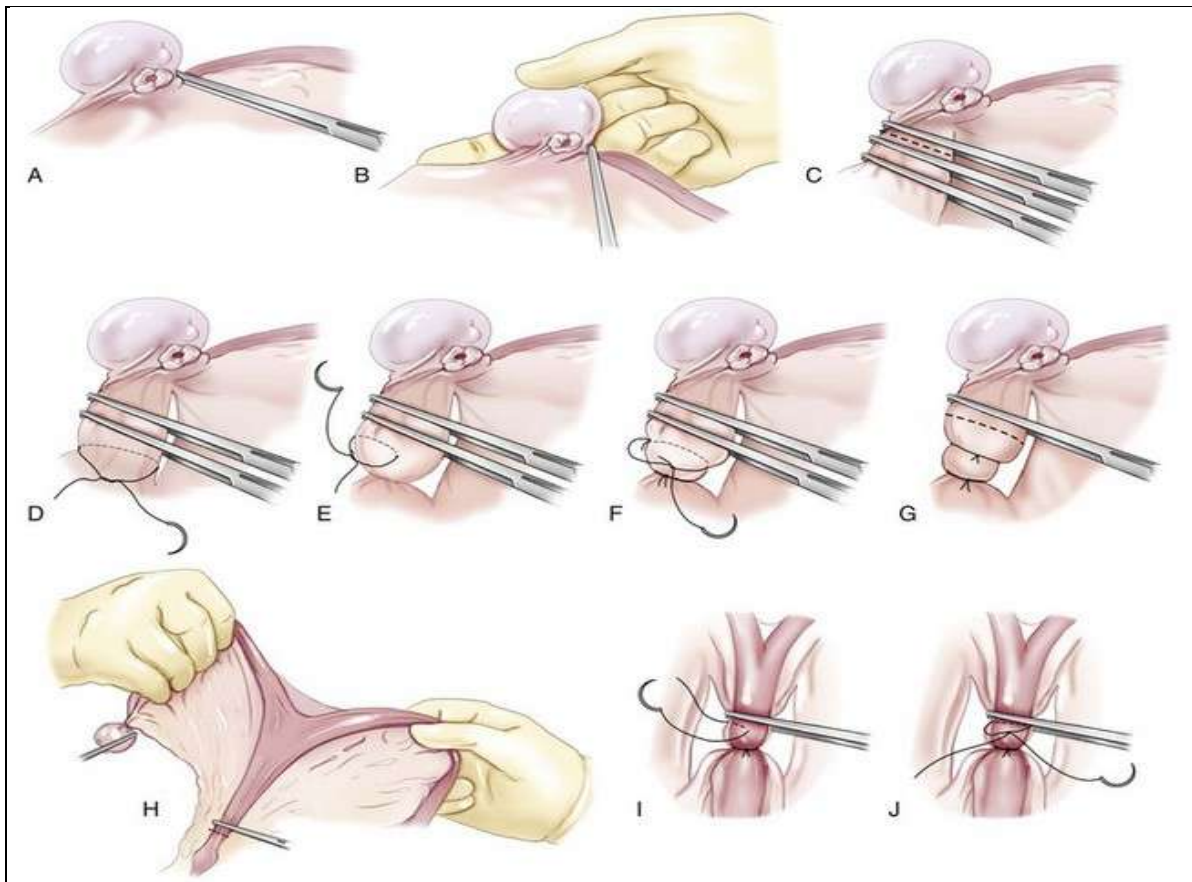


Fig A: Placing of Babcock forceps in ovarian pedicle

Fig B: Grasping ovarian pedicle with forceps

Fig C: Placing a clamp between ligature and the ovary

Fig D, E, F: Placing two ligatures between ovarian vasculature and pedicle

Fig G: Ligation of broad ligament

Fig H: Forceps placement near cervix

Fig I, J: Ligation of the cervix and uterine vasculature

EXERCISE

1. Write down the indications of ovario-hysterectomy in small animals

Signature

Practical No. 13

DEMONSTRATION OF REPRODUCTIVE PATHOLOGICAL CONDITIONS USING MUSEUM SPECIMENS

In early embryonic development, the primitive structures become the gonads and other portions of the genital tracts of male and female embryos are morphologically identical. The undifferentiated gonads are therefore bipotential, the ambisexual stage. In mammals, the default sex is the female. Female sexual differentiation does not require products from the fetal ovary. It is only hormones produced by the fetal testicle that act to control further development of the genitalia into male reproductive organs. The situation is reverse in birds.

Reproductive pathological conditions:

Sexual differentiation: Sexual ambiguity or intersex: denotes those developmental abnormalities in which a discordance exists at genetic, gonadal, and phenotypic levels.

a) Intersex: occurs when the embryo a) has abnormal chromosome components or b) is of combined gonads or is under inappropriate hormonal influence, thereby causing inappropriate development or regression of the paramesonephric and mesonephric duct systems.

b) Hermaphrodites have ambiguous genitalia, with parts or all of the genital organs of both sexes present.

1. True hermaphrodites possess both ovarian and testicular tissues (ovary, testis, or ovotestis). The external genitalia exhibit varying degrees of male and female differentiation. Affected animals are usually infertile. Rarely, they can ovulate and become pregnant, but in these cases the testicular tissue usually lacks germ cells.



True hermaphroditism in goat

2. Pseudohermaphrodites have only a single type of gonadal tissue, and the animal is classified as either a male or female pseudohermaphrodite on the basis of the gonadal tissue present:

1. Abnormalities of genetic (chromosomal) sex: It may involve sex chromosome number, e.g. XXY, XO and XXX syndromes. Some of these abnormalities result in hypoplastic ovaries without follicles. Inadequate production of estrogen leads to infantilism of the rest of the genitalia.

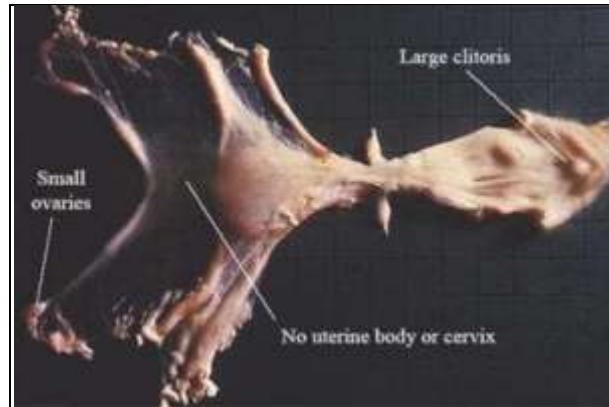
2. Abnormalities of gonadal sex: It results when the genetic sex and gonadal sex of the individual do not agree.

- a. XY sex reversal: resulting from a mutation with variable expression in the Y chromosome.
- b. XX sex reversal: a male differentiating gene mimics the action of the SRY gene (Sex-determining region of the Y chromosome): such as the chromosome that polling (hornlessness).

Freemartin bovine calf, a genetic female born co-twin with a male: Normally, male differentiation occurs before female differentiation. Nearly all male-female twinning in Cattle result in the female becoming a freemartin. Vascular anastomoses develop between both placentas and allow products of the SRY gene from the male fetus to move to the female fetus, thus influencing the development of her undifferentiated gonads.

Characteristic features of the freemartin female calf: small ovaries resembling testis histologically, poor to well developed uterus but without communication with the vagina,

poorly developed vagina with complete hymen and enlarged clitoris, hypoplastic mammary gland, poorly developed epididymis and spermatic cord and presence of vestigial seminal vesicles. The effect of the association on the male twin is always minimal.



Freemartin condition

3. Abnormalities of phenotypic sex: It occurs when chromosomal and gonadal sex coordinate, but the internal or external genitalia are ambiguous. Affected individuals are either male or female pseudohermaphrodites.

a) Female pseudohermaphrodites: may result from iatrogenic administration of androgens or progestagens to their pregnant mothers.

b) Male pseudohermaphrodites: It occurs in animals with normal-appearing female external genitalia and a vagina that ends blindly (no cervix or uterus is present); the gonads are clearly testicular, but present in the normal ovarian position. It may result from androgen insensitivity, caused by a deficiency of intracellular androgen receptors, forming a spectrum of syndromes of partial to complete resistance to androgens. The most striking example of resistance to androgens is complete testicular feminization. In rare instances, Leydig cells (the interstitial cells of the testes) are absent or greatly reduced in number. Presumably the receptors for luteinizing hormone (LH) are defective. Without Leydig cells, only small amounts of testosterone are produced.

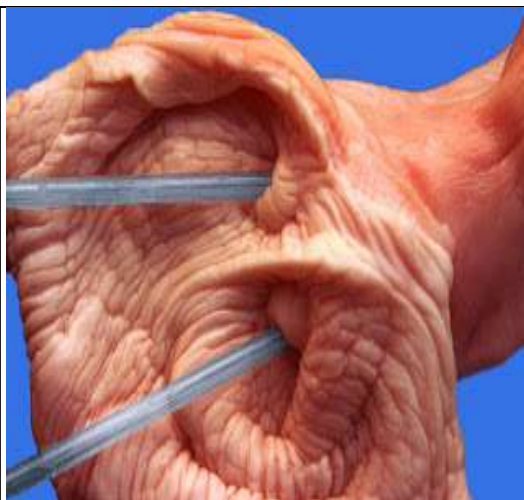
Anomalies with normal sexual development:

Female individuals with normal sexual development could still have anomalies in the development of the paramesonephric duct system. Most of them fit into the categories of failure of normal maturation, hypoplasia, and aplasia.

- a) Segmental aplasia of the uterus: The blind portion of the uterus, proximal to the area of segmental aplasia, may be distended with normal secretions and sloughed off cells which form soft concretions.
- b) Imperfect fusion of the paramesonephric ducts: double vagina cranial to the urethral orifice, double cervix, or double cervix and uterine body (uterus didelphus).
- c) Persistent hymen: complete or partial failure of fusion of the paramesonephric ducts. With the urogenital sinus, resulting in the persistence of a membrane just cranial to the urethral orifice. If complete, large amounts of normal secretions may accumulate in the cranial portion of the vagina, the cervix and the uterus, leading to distention and atony.
- d) Cystic remnants of mesonephric ducts and tubules: found in or near the ovaries (paraovarian cysts) and uterine tubes; most of these do not interfere with fertility or cause clinical signs; paraovarian cysts are movable on the surface of the ovary, which distinguishes them grossly from ovarian follicular cysts.
- e) Cystic apical segments of the paramesonephric duct: fimbrial cysts; do not interfere with fertility or cause clinical signs.



Uterus unicornis



Double cervix

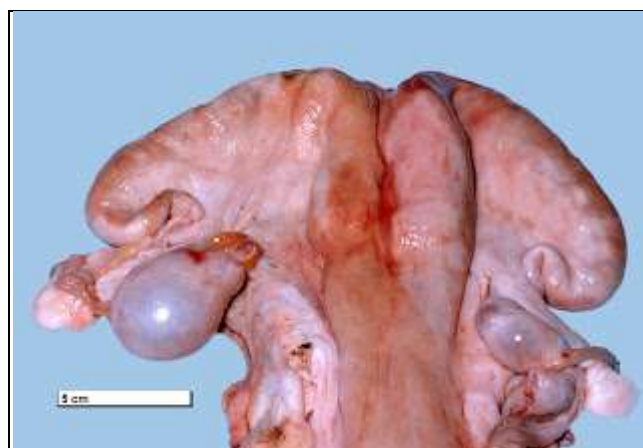
OVARIES

1. Developmental anomalies

Agenesis of gonads (uni- or bilateral): means absence of ovary. Birds normally have only a left ovary

Cystic ovarian condition

1. Follicular cysts or cystic Graafian follicles: Follicles larger than they should normally be at ovulation (2.5 cm in cattle). Diameters of normal follicles near ovulation are approximately 2 cm in the cow, 1 cm in the sheep and pig, and 0.75 cm in the dog. Follicular cysts can cause prolonged estrus cycle or anestrus. When they persist, they can cause changes related to prolonged estrogen stimulation, e.g. nymphomania, enlarged uterus with edematous wall, cystic endometrial hyperplasia, enlarged cervix, edema of vulva, enlarged clitoris, cystic Gartner's ducts (mesonephric duct remnants that lie in the wall of the vagina), and cystic Bartholin's glands.
2. Luteinized (or luteal) cysts: They are a milder form of follicular cysts and are more common. They develop when ovulation fails to occur and the granulosa cells and theca interna cells undergo luteinization; may cause prolonged anestrus due to elevated progesterone. Multiple luteinized cysts are a distinctive feature of cystic ovarian disease in swine.
3. Cystic corpus luteum: It has an ovulation papilla that distorts the outline of the cyst at the point of ovulation. Cystic corpus luteum does not interfere with the estrus cycle.



Cystic ovarian degeneration

Primary neoplasms: Primary Ovarian tumors may arise from the gonadal stromal tissue, the surface epithelium, or the germ cells.

a) Gonadal stromal tumors: It includes tumors of granulosa and theca cells and their luteinized counterparts in large animals and bitches, usually unilateral and non-malignant. This group of tumors frequently produces hormones estrogens, progesterone, or even androgens. They cause nymphomania, less commonly masculine behaviour in cows, and anestrus, intermittent or continuous estrus, or stallion-like behaviour in mares.

b) Papillary and cystic adenomas and adenocarcinomas: These are often bilateral, with a shagreened surface, and can be up to 10 cm in diameter, arise from the surface epithelium of the ovary. Commonly occurs in the bitch.

c) Germ cell tumors

1. dysgerminomas

2. teratomas

d) Hemangioma: It arises from uncoordinated and excessive growth of blood vessels in the corpus luteum.

FALLOPIAN TUBES

Hydrosalpinx: It may be congenital, secondary to segmental aplasia of the uterus, or secondary to trauma (e.g. during manual manipulation of the ovary in cattle) or chronic inflammation. It is a common cause of sterility in sows.



Hydrosalpinx

UTERUS

1. Non-inflammatory diseases

(a) Rupture can be from trauma at parturition or iatrogenic during infusion or obstetrical manipulation. It can lead to fatal internal haemorrhage or perimetritis and peritonitis.

(b) Torsion occurs in a uterus enlarged by pregnancy, pyometra or mucometra. Rotation tends to occur at the level of the cervix in the cow and at the junction of the uterine horn and body in the bitch and queen. Minor degrees of torsion (up to 90°) are fairly common in cows and apparently resolve themselves. Torsions of 180° or more cause dystocia and interfere with circulation.

If the fetus dies and air and bacteria enter the uterus, the fetus putrefies. If the cervix remains closed, the fetus mummifies; if the uterus ruptures, the fetus escapes into the abdominal cavity but still undergoes mummification. In some cases, the mummified fetuses can remain in the peritoneal cavity for months or years without causing clinical signs.

(c) Prolapse occurs after parturition and is encountered mainly in ruminants. Predisposing causes are those related to uterine hypotony or to dysrhythmia of involutionary contraction, e.g. prolonged dystocia relieved by forced traction, retained placenta, postparturient hypocalcemia, or hyperestrogenism resulting from ingestion of legumes with a high content of oestrogens. The resulting hemorrhage and shock can cause death. If the prolapse is corrected, damage to the uterus resulting from drying, trauma, venous infarction and infection will likely prevent future fertility.

(d) Endometrial polyps are common in older bitches and queens. Large polyps may provide sufficient mass that uterine contractions can mechanically force prolapse of the affected horn.

(e) Endometrial hyperplasia is usually due to excess hormonal stimulation. In farm animals, it occurs during prolonged hyperestrogenism as seen in cystic ovarian disease, granulosa cell tumors, or following ingestion of estrogenic pastures (such as some strains of clover) or of grain contaminated by the mycotoxin zearalenone. Lesions are at first simple,

thencystic, and can become infected, leading to pyometra. The cystic lesions are probably notreversible.

In the bitch, a low-grade, subclinical bacterial infection of the uterus may cause the endometrium to proliferate during the luteal phase of the estrous cycle, when it would normallybe responsive to the presence of embryos in the pregnant animal and become an intimate part ofplacental structures. This demonstrates the sensitivity of the canine endometrium to intraluminalmaterial during this phase of the estrous cycle. Changes in the uterine environment may then leadto massive bacterial proliferation, transforming the subclinical infection into pyometra. Endometrial hyperplasia is a significant precancerous lesion in women, but not in domestic animals.

(f) Hydrometra is accumulation of watery fluid, and mucometra is accumulation of mucus, in the uterine lumen. They are due to endometrial hyperplasia or congenital obstruction. Affected animals are sterile.

(g) Adenomyosis is the presence of nests of endometrial glands within the myometrium, either as a malformation or by hyperplastic overgrowth of the endometrium (as in cystic endometrial hyperplasia).

(h) Pseudopregnancy in bitches is an exaggerated form of the normally long luteal phase of the estrus cycle in this species. Some dogs, especially of the toy breeds, may have an unusual high production of the hormone prolactin or an unusually high response to its effects. Changes include formation of placental sites in the uterus, mucometra, and development of themammary glands. Some of the uterine changes may predispose to infection and pyometra.

(i) Subinvolution of placental sites occurs in young bitches and is manifested by prolonged bloody vaginal discharge postpartum (lasting for several weeks or months instead of the normal 7-10 days following whelping). In some cases, the blood loss causes severe anemiaand occasionally death. The cause is unknown. Microscopically, the former placental sites areinfiltrated by large numbers of large cells interpreted as either syncytial trophoblastic cells (fromthe fetal side of the placenta) or decidual cells (from the endometrial side of the placenta), someof which may invade the myometrium or even perforate the serosa, allowing the uterine contentsto escape into the peritoneal cavity.



Sub-involution of placenta sites

(j) Uterine serosal inclusion cysts arise by pinching off of surface mesothelial indentations, either during normal uterine involution or in association with perimetritis. They are seen in aged pluriparous bitches and less commonly in ruminants.

2. Inflammatory diseases:

Uterine infections are mostly ascending through the cervix, less commonly hematogenous, occasionally from the ovary and uterine tube, and rarely transneural as in herpesvirus infection.

(a) Endometritis refers to inflammation of the endometrium. At necropsy, acute endometritis is difficult to diagnose grossly unless there is copious fibrinous, purulent or necrotic exudate. In cattle, a few leukocytes in the endometrial stroma are present during the estrus and follow within 2-3 days of parturition. Chronic endometritis is characterized by an accumulation of plasma cells and lymphocytes in the endometrial stroma and by periglandular fibrosis.

In cattle, endometritis may result from dystocia and retained placenta in the early postpartum period, or at various times after breeding as a result of venereal infection (e.g. *Tritrichomonas fetus*) with early embryonic death.

(b) Metritis is inflammation of all layers of the uterine wall. The uterus is paretic and there may be little or no vaginal discharge.

(c) Pyometra is accumulation of pus in the lumen of the uterus. Escape of the pus is usually prevented by a functionally closed cervix. Pyometra in the bitch is a disease that characteristically affects older animals, especially those that are not bred. The condition most often develops a few weeks after estrus. The cervix is closed as a functional response to luteal hormones. The uterine wall is friable, and rupture or perforation with secondary peritonitis may occur. Bacteria most commonly present in pyometra are strains of *E. coli* that are also present in the faeces, most of these strains are also urinary tract pathogens, and their uropathogenic virulence factors may enhance their pathogenicity in the genital tract. Pyometra can be a life-threatening condition in the bitch. There can be severe bacterial toxemia, bone marrow depression, glomerulonephritis resulting from immune-complex deposition, and polyuria from impaired renal tubular ability to concentrate urine, which may also have an immunologic basis. In cattle, pyometra is not usually life-threatening as it is in bitches.



Endometritis

Metritis

VAGINA AND VULVA

a) Gartner's ducts are microscopic remnants of the embryonic mesonephric ducts lying beneath the epithelium, one on each side of the floor of the cranial portion of the vagina. They can become cystic in cows poisoned with highly chlorinated naphthalenes, in cases of hyperestrogenism (e.g. secondary to ovarian follicular cysts), or secondary to vaginitis.

b) Vestibular (Bartholin's) glands are female accessory sex glands lying on each side of the floor of the vestibule. They can become cystic under the same stimuli as cystic Gartner's ducts, but more frequently as a result of inflammation.

c) Tumefaction (hypertrophy and edema) of the vulva is normal during estrus but can be excessive or persistent in hyperestrogenism. In swine, it can result from the feeding of mouldy grain containing the mycotoxin zearalenone, which mimics the effects of estrogen. Young gilts are more susceptible than older animals. Severe edema of the vulva and vagina may lead to prolapse of the vagina and then of the rectum.

d) Vaginal polyps are common in older bitches.

EXERCISE

1. Describe following conditions:

- a. Schistosomus reflexus
- b. Perosomus elumbis
- c. Achondroplasia
- d. Difference between monster and anomaly

Signature

Practical No. 14

SEXUAL HEALTH CONTROL IN DAIRY FARMS

Objective:

1. To prevent and control, reproductive problems in order to maintain the rate of reproduction in a herd on a level allowing the highest possible economic return
2. To detect the infertile or sterile animals in good time for culling

Herd fertility: The management of dairy herds for maximum productivity implies maintenance of a desirable level of fertility. A useful working aim is the production of one healthy calf each year by each cow i.e, a calving interval or calving index of 365 days. A desirable post-calving interval is 60 days and it is commonly recommended to serve or inseminate at the first oestrus after 60 days.

Indications of infertility problem in a herd when:

1. Calving interval (index) exceeds 400 days.
2. Calving-conception interval exceeds 120 days.
3. First service conception rate is less than 50 per cent.
4. Average number of services per conception exceeds two.
5. At least one-third of the females require more than three services per calf

Implementation of the programme:

In the management of a herd, sexual health control gives an effective check on the reproductive performance of the male and female. The success of such a programme depends upon many factors involving the management of the herd and the veterinarian in-charge. The veterinarian must be prepared to render the following services

1. Early pregnancy diagnosis
2. Management of anoestrus and repeat breeding problems
3. Supervision and correction of management and breeding practices
4. Assistance in selection of animals for culling
5. Examination of bulls in naturally bred herds

The steps essential for an organized approach to sexual health control programme include

1. Client education
2. Collection and processing of data
3. Routine examination of all eligible animals
4. Assessment of reproductive performance
5. Establishment of herd reproductive goals.
6. Implementation of management changes to obtain goals
7. Monitoring herd response

1. CLIENT EDUCATION

The client must be made aware that all increases in reproductive efficiency, thereby profit, depend largely on improving his management skills and also that it is not always possible for a veterinarian to be present personally. Hence, it is essential to make the farmers acquainted with certain aspects such as

1. Detection of oestrus
2. Breeding practices
3. Type of normal oestrus discharge and discharge in pathological conditions (metritis, endometritis, pyometra etc)
4. Signs of parturition
5. Symptoms of mastitis
6. Calving practices
7. Normal time required for expulsion of placenta and lochial discharge
8. Vaccination programmes
9. Herd nutrition
10. Heifer management

2. COLLECTION AND PROCESSING OF DATA

A Simple and accurate method of collecting and processing herd reproductive information must be established. The life history card of the female is very ideal to record all possible information from birth onwards. The most important responsibility of the manager is to

maintain herd reproductive records Adequate reproductive records are indispensable for success of fertility examination programmes. The record must contain all essential information, which includes

1. Identification of the animal
2. Date of birth
3. Dam and sire
4. Dates of service and bulls used
5. Dates of oestrus
6. Dates and findings of genital examinations
7. Dates of treatment and therapy administered
8. Dates of diagnosis "pregnant
9. Dates of calving
10. Dates of abortion and other pathology of pregnancy

The record should be so designed that information can be obtained at a glance on items of interest which include

1. Calving interval
2. Days open
3. Services per conception
4. First service conception rate
5. Days in milk to first service
6. Percentage of cattle observed and recorded in oestrus by 60 days fresh
7. Average age of heifers at freshening

3. ROUTINE EXAMINATION

a) Initial examination:

All female animals of breeding age should be examined at the time of initial examination to obtain information about the reproductive status of the herd. In naturally bred herds, the herd bull or bulls should be examined especially if the fertility status of the herd is poor and the female should be watched for genital discharges, prior to and following each service.

Behaviour of the bull during natural service should be watched to detect deviations. Service record of the bulls should be properly studied with particular reference to their conception rate. New bulls should be introduced in the herd after proper andrological examination. In the examination of a bull, close observation should be made with regard to the size, consistency and placement of the testicles.

All findings are to be recorded and these along with the breeding history should be evaluated and discussed to come to a realistic prognosis, in regards to the problem females in the herd which are to be examined upon in the follow-up examinations.

b) Regular follow up examination:

On a monthly basis the following animals should be examined per rectum, appropriate individual treatments administered and all results recorded

1. All cows fresh 14 days or more.
2. Cows with abnormal discharges
3. Cows with abnormal oestrous cycles.
4. Any cow fresh 60 days and not observed in oestrus.
5. Any cow bred three or more times.
6. All cows bred 32 days or more ago that did not return to oestrus.
7. Recently aborted animals.

Those which are due for pregnancy diagnosis and those in anoestrus conditions should be examined first, whereas, others with history of abortion should be examined at the end. In addition, at least twice a year, evaluations should be made of heifer growth rates. Age, height and weight values need to be recorded and compared to breed standards

4. ASSESSMENT OF REPRODUCTIVE PERFORMANCE:

Evaluation of the herd reproductive data enables one to establish a herd baseline. The terminal indicator of herd reproduction is the calving interval. All other indices represent areas that support or deny an acceptable calving interval.

5. REPROUDCTIVE GOALS

Achievable reproductive goals are

- A. 12 months calving interval
- B. 85 days open
- C. 1.6 services per conception,
- D. 60 % first service conception rate.
- E. 85% of cows observed in oestrus and recorded by 60 days fresh.
- F. 90% of cows bred between 60 and 84 days fresh
- G. 90% of heifers calving at 24 months of age.

6. IMPLEMENTATION OF MANAGEMENT CHANGES TO OBTAIN GOALS

After a reproductive summary has been produced and evaluated, management changes may be necessary to reach acceptable goals Evaluation of the reproductive summary allows attention to be focused on problem areas such as

- 1. Cow nutrition
- 2. Lactation nutrition
- 3. Calving environment
- 4. Periparturient procedures
- 5. Breeding management
- 6. Oestrus detection
- 7. Timing of insemination
- 8. Insemination techniques
- 9. Bull management
- 10. Venereal disease
- 11. Heifer management.

An increased incidence of retained placenta demands a review of the dry cow nutrition progress; whereas increases in retained placenta with weak, dead or premature fetuses require investigation into possible causes of abortion An unacceptable level of postpartum metritis indicates problems in the calving environment and poor calving practices.

It is essential that all calving occur in a clean, dry, well ventilated area. Maternity pens should be isolated from the rest of the herd. Neonates require naval disinfection and the intake of colostrums within 6 hours of birth. Colostrum should be hand-fed to ensure adequate intake. All cows returning to service three or more times should be re-examined to determine possible causes of infertility. An abnormal elevation in the number of repeat breeders indicates problems with:

1. Timing of insemination.
2. Semen handling
3. Semen quality or bull fertility.

Age at first freshening is the final measurement of young stock management practices.

Factors influencing age at first freshening include:

1. Sanitation
2. Housing
3. Ventilation
4. Disease prevention
5. Parasite control
6. Nutrition
7. Breeding practices

Because age at first oestrus is largely a function of size, dairy heifers must grow at a rate that ensures that they will attain 65% of their mature body weight by 14 months age.

7.MONITORING HERD PERFORMANCE

The key to success in a complete reproductive program is frequent continuous monitoring of current values. Regular re-evaluation of calving interval, days open, first service conception rate, services per conception, days to first service, and age at first freshening provide a basis for recommendations and management changes made in pursuit of maximal productivity.

EXERCISE

- 1. Collect and record the reproductive data of cattle and buffalo present in LFC**

Signature

Practical No. 15

CAESAREAN SECTION IN BOVINES

Indications: Caesarean section is done as a last resort to deliver the foetus in

- Cases of narrow pelvis
- Uncorrectable foetal mal-presentations
- Delayed cases of uterine torsion
- Foetal monstrosities
- Incomplete dilatation of cervix
- Vaginal and cervical tumours.

Anaesthesia:

Local linear infiltration of the incision line with 2% Lignocaine hydrochloride(60-90 ml) is the most preferred procedure, however, paravertebral blocks (T13, LI, L2,and L3) are also practiced when the operation is performed in standing animals. For linear infiltration, the anaesthetic agent is first infiltrated sub-cutaneously in both directions at the point of prick followed by administration in the musculature. Parietal peritoneum however, may not be properly desensitized.

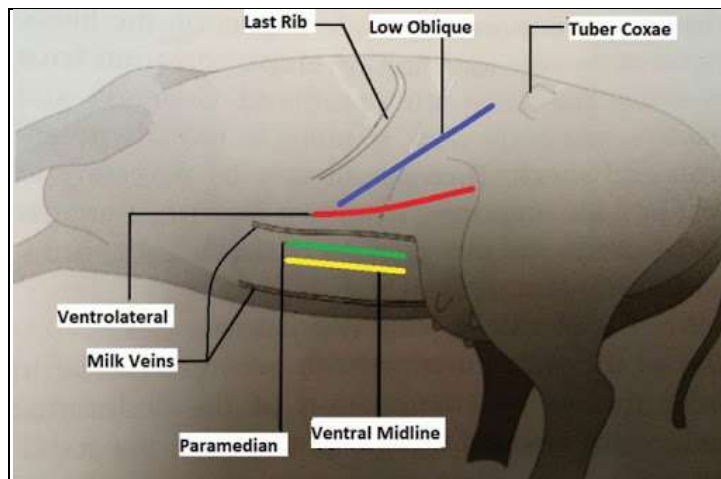


Lignocaine hydrochloride

Site of operation:

Depending upon the general condition of the animal, the caesarean section is either done in standing animal or when casted in right lateral recumbency. Caesarean section is preferably

done on the left side because of intestinal loops on the right side, which may hinder the operation. When performed in lateral recumbency, the line of incision is often paramedian, parallel to the milk vein. It can be pre-crural also. In standing animals, the operation is done from the lower left flank region.



Different sites of operations for C-section

Procedure:

After proper restraint (in lateral recumbency), through preparation of the site and anaesthesia, skin is incised followed by blunt dissection for its preparation from the fascia. Abdominus obliquus externus, rectus abdominus and aponeurosis of abdominus obliquus internus and transverse abdominus muscles are cut. After incising the peritoneum, omentum that covers the uterus and the intestines is reflected. It is pushed forward and downward and packed below the rumen. Make sure that peritoneal cavity is properly packed to minimize spilling of uterine fluids. After exposing the uterus, foetal parts are palpated to confirm pregnant horn. If non-pregnant horn is presented, it should be rotated to get the pregnant horn near the incision line. Grasp the foetal extremity and try to exteriorize the uterus along with the foetal part. omentum ward and packed below the rumen. Preoperative administration tocolytic drug (B-adrenergic agonist) like Isoxuprine lactate or Clenbuterol will help to exteriorize the uterus.

Then a stab incision is made on the pregnant horn in between the maternal caruncles that can be easily palpated as hard protuberances. Using the groove director or guiding with your finger use scissors to extend the incision line. Care should be taken to avoid incision on the

caruncles that can cause profuse bleeding. The incision length should be enough for easy delivery of the foetus while pulling it out of uterus irregular foetus tear would occur in the uterine wall. Preferably grasp the hind limbs of foetus and bring them out. Pull the foetus obliquely and posteriorly to deliver it. Placenta if loosely attached is taken out after delivering of fetus. The uterus is properly cleaned preferably with weak povidone iodine solution. The uterus sutured with chromic catgut No. 3 or polyglycolic acid in continuous Lambert or Cushing pattern in single or double layer. It is important to embed the first knot in the uterine tissue and keep the stitches in oblique fashion while passing the round needle through the uterine tissue. This would help to reduce the chances of uterine adhesions. The suturing should be quick as in fresh cases the uterus involutes rapidly and suturing may become difficult .After stitching, the uterus is thoroughly cleaned with sterile gauge and normal saline solution and put back to its position.

See no uterine torsion occurs while replacing it or should be removed if surgery is performed in a case or uterine torsion. Do not forget to remove the drapes put in the peritoneal cavity before its closure. Water soluble antibiotics like penicillin and streptomycin maybe infused into the peritoneum before its closure. Before closure of the wounds to prevent uterine adhesions, sterilized solution of carboxy methyl cellulose sodium (1%) can infused intra-peritoneally. Peritoneum and abdominal muscles are sutured with braided silk no. 2 or 3 in continuous lock-stitch pattern in two layers. Avoid creation of dead space in between the muscles while suturing by taking deep tissue bites. Interrupted horizontal mattress sutures are applied on the skin with silk.



Uterine incision

Exteriorization of pregnant uterine horn



Removal of fetus



Removal of after birth



Closure of uterus using Lambert's suture Closure of abdominal muscles

Post-operative care:

Supportive therapy consisting of intravenous fluids, a course of antibiotics, local wound dressing, a non-steroidal anti-inflammatory drug and ecboic should be administered. Calcium borogluconate to check hypocalcaemia and hasten uterine involution should be given. Cases having severe toxemia need critical care after surgery.

Complications:

Three major post-operative complication of caesarean include peritonitis, adhesion of the uterus with surrounding viscera and wound dehiscence.

Peritonitis is characterized by fever, inappetence, constipation or diarrhoea and arched back. Wound infection and dehiscence are common in cases where surgery is done at para median site. The future fertility of the caesarean operated cases remains guided due to uterine adhesion.

Occasionally sub-cutaneous emphysema can develop in cases where the peritoneum has not been opposed properly. This is true in animals where surgery is performed at flank region as at this site more of air is sucked into the peritoneal cavity. Placenta may be retained in majority of cases if it is not separated at the time of surgery. This may be warrant intra-uterine and parenteral antibiotic administration.

EXERCISE

- 1. Write down the different anaesthetic agents with dose, site of operation and post-operative management followed in various species.**

Signature