PRACTICAL MANUAL

OF

VETERINARY ANATOMY

(B.V.Sc. & A.H. FIRST PROFESSIONAL YEAR 2023-24)

Volume II (Unit- IV, V, VI)

DEPARTMENT OF VETERINARY ANATOMY & HISTOLOGY

MJF COLLEGE OF VETERINARY & ANIMAL SCIENCES,

CHOMU, JAIPUR (RAJASTHAN)

PRACTICAL MANUAL

IN

VETERINARY ANATOMY

NAME: . . . . . .

ROLL No. :. . . . . .

Batch: . . . . . .

1st Year B.V. Sc. & A.H. (2023 - 24)

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CERTIFICATE

This is to be certify that Mr. /Ms. ……..…… ……..… Roll. No……of First year B.V.Sc & A.H. has successfully completed all practicals in Veterinary Anatomy during first year of the academic year ……

Date :

Place :

Signature of Head of Department **Signature of Course Teacher**

FOREWORD

I am very happy to go through the Practical Manual entitled "Veterinary Anatomy" Department of Veterinary Anatomy & Histology, MJF College of Veterinary & Animal Sciences, Chomu, Jaipur (RAJ.) The Manual covers the practical syllabus of undergraduate course (Veterinary Anatomy, Volume II) prescribed by Veterinary Council of India (MSVE 2016) 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, procedures and observations to be taken have been nicely presented which would be helpful in conducting practicals more effectively.

I hope this manual will make its own place in the libraries of Veterinary and Animal Science Colleges/Universities 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

ACKNOWLEDGEMENT

Ever since the introduction of new course for professional B. V. Sc. & A.H. degree programme under Veterinary Council of India pattern in Veterinary Colleges/Universities in the country, there was a dire need to have a practical manual on Veterinary Anatomy subject which covers the practical syllabus of undergraduate (Veterinary Anatomy). This new course was not independently developed in most of the Veterinary College/University before the introduction of Veterinary Council of India programme. The present manual covers the practicals with objectives, material required, procedure, steps to follow, precautions to be taken, observations to be recorded and exercise to be done by the students. We hope that users will find the manual immensely useful.

We look forward to receiving the valuable suggestions of users for improvement of this manual

Name & Roll No. of the student: _____

INDEX

UNIT IV

S.No.	Title	Page No.	Date	Signature

Name & Roll No. of the student: _____

UNIT V

S.No.	Title	Page No.	Date	Signature

Name & Roll No. of the student: _____

UNIT VI

S.No.	Title	Page No.	Date	Signature

Practical No. 1

To study the thoracic vertebrae, ribs and sternum of ox, horse, dog, pig and fowl

The vertebral column is subdivided into five regions:-

Cervical- Neck

Thoracic – Back

Lumber- Loin

Sacral – Croup

Coccygeal – Tail

The number of vertebrae in each region except the last is more or less constant for each animal. Thus the vertebral formulae of the different animals are: -

Species	Cervical	Thoracic	Lumbar	Sacral	Coccygeal
Ox	7	13	6	5	18-20
Horse	7	18	6	5	15-21
Dog	7	13	7	3	20-23
Pig	7	14-15	6-7	4	20-23

A typical vertebra consists of:

Body – Centrum

Arch – Lamina and pedicles

Processes:- Articular process

Transverse process

Spinous process

Besides these processes, certain vertebrae have mammillary process (posterior thoracic, anterior lumbar vertebra) and accessory process.

The vertebrae of different regions can be identified by certain character:

Thoracic Vertebrae: -

Facets for articulation with the ribs

Long spinous processes.

Identification of Species: -

Ox: -

There are 13 thoracic vertebrae.

Horse: -

These are 18 in number.

Dog: -

These are 13 in number.

Pig: -

These are 14-15 in number.

Fowl:-

The thoracic vertebrae posses vertebral and sternal components.

These are 7 in number.

Ribs are described as having: -

A. **shaft:** - two surfaces

Lateral surface: - is convex in its length. Its anterior part is grooved longitudinally.

Medial surface: - is smooth, concave in its length and rounded form side to side. The costal groove is situated posteriorly and is very above but fades out further down.

B. **Two extremities**: -

I) **Vertebral extremity: -** consists of head, a neck and a tubercle.

II) **Sternal extremity: -** is elongated and twisted with sternal cartilages.

Identification of species: -

Ox: -

There are thirteen pairs of ribs. First eight are sternal and rests five are asternal.

The shaft is elongated, wide, flattened and curved.

Horse: -

There are 18 pairs of ribs (eight sternal and rest ten are asternal).

The shaft of the ribs is elongated, narrow and more strongly curved and regular than in the ox.

Dog:-

There are thirteen pairs of ribs (nine sternal and four asternal)

They are strongly curved, narrow and thick.

Pig:-

14 to 15 pairs of ribs are present.

Sternal ribs: - 7 pairs.

Asternal ribs: - 7 to 8 pairs.

Floating ribs: - last ribs are usually small and floating.

The first rib of ox differs from the typical ribs by following characters.

- This is shorter and straight.
- Shaft greatly widens towards the sternal end.
- **Costal** groove is absent.
- Neck is thick and very short.
- The tubercle is larger than that of any other rib and has an extensive articular surface.

Fowl:-

- In birds there are seven pairs of true ribs, which consist of dorsal segment i.e. vertebral rib and ventral segment, sternal rib.
- The first two of the seven pairs of the rib usually lack the sternal articulation.
- Except for the first and last, the vertebral ribs posses uncinate process.

Sternum: -

Ox: -

It is dorsoventrally flattened, wide and consists of seven sternebrae.

It has two surfaces (dorsal and ventral), two lateral borders and two extremities (anterior extremity and posterior extremity).

The anterior extremity known as manubrium sterni is formed by the summit of the first sternebra .

The last segment tapers backwards.

The posterior extremity is formed by xyphoid cartilage.

Horse: -

The sternum of horse consists of 8 Sternebrae.

The sternum of horse is canoe (boat) shaped.

It is compressed laterally except in the posterior part.

The ventral border forms the prominent keel like crest of the sternum.

The manubrium sterni consist of laterally compressed cartilaginous prolongation known as cariniform cartilage.

Dog: -

It consists of eight sternebrae which fuse only in exceptional case or in the old age.

It is long and laterally compressed.

The anterior end of the first segment is blunt-pointed and bears a short conical cartilage.

The last segment is also thinner than its predecessors, wide infront and narrows behind where it bears a narrow xyphoid cartilage.

Pig: -

Six sternebrae fused to form sternum.

The manubrium sterni is elongated and compressed from side to side.

Other sternebrae are dorsoventrally compressed.

Xyphoid process is long and the xyphoid cartilage is small.

Fowl:-

The sternum is an extensive bone exhibiting a large ventrally directed kell/carina. The caudal region of sternum is known as metasternum. The area of attachment of sternal ribs is known as **costal-sternum**. Cranially sternum projects laterally a pair of sternocoracoidal process and medially there is a single bony projection known as **manubrialspine**.

The cranial most point of the keel is known as cranial apex/sterna keel.

Exercise:-

1. Draw the diagram of ribs and sternum of ox, horse, dog, pig and fowl.
2. Draw the diagram of thoracic vertebrae of ox, horse, dog, pig and fowl.

Practical No. 2

To study the muscles of thorax

Q: Enlist muscles of back thorax and sub- lumbar region?

Practical No. 3

To Study the Pulmonary and Thoracic aorta

A. Pulmonary trunk: The pulmonary trunk springs out from the conus arteriosus at the left side of the base of the right ventricle and caudal to the aortic arch it divides into right and left pulmonary arteries. It is related cranially to the right auricular appendix and caudally to the left auricular appendix and medially to the aorta. Near the bifurcation it is connected with the aortic arch by a fibrous band called **ligamentum arteriosum**, a remnant of the foetal ductus arteriosus.

1. **Right pulmonary artery:** It is longer and larger than the left. It passes under the bifurcation of the trachea to the hilus of the lung. It has four braches named according to the lobes of the lung to which they are distributed.
2. **Left pulmonary artery:** It has three branches. Branch of the apical lobe is the smallest. Within the lung the pulmonary artery follows closely the course and braches of the bronchi.

B. Systemic arteries:

The Aorta: The aorta is the main systemic arterial trunk and it begins at the base of the left ventricle. Its first part, the ascending aorta, passes dorsally and cranially and supplies the neck, forelimb and head, and cranial portions of thoracic cavity. The main aorta then curves sharply caudally and dorsally, and inclines somewhat to the left, forming the **aortic arch**. At its origin, the caliber is greatest forming the bulbus aorta and here it present three dilatations **the aortic sinuses** (sinuses of valves). It continues caudally as the **descending aorta**.

The aorta then reaches the level of the body of the seventh or eighth dorsal vertebrae, runs backwards as the **thoracic aorta**, between the lungs below the bodies of the last five or six dorsal vertebrae. It lies at first to the left of the median line then gradually inclines inwards, reaches the hiatus aorticus, where it is median in position. Passing through the hiatus aorticus, it enters the abdomen as **abdominal aorta,** passes backwards below the bodies of the lumbar vertebrae and the psoas pervus muscles in contact with the left crus of the diaphragm. At the level of the 5^{th} or 6^{th} lumbar vertebra it divides into two internal and to external iliac arteries. From this bifurcation a small vessel, **median (middle) sacral artery** arises and continues caudally as the middle coccygeal artery at the level of 1^{st} coccygeal vertebra which supplies the tail.

Collateral Branches

1. **Coronary arteries**
2. **Common brachio-cephalic trunk:** It is very large vessel which arises from the convexity of the aortic arch within the pericardium and is directed cranial and dorsal to the trachea, and to the left of the anterior vena cava. **At the level of the 2^{nd} inter costals space it gives off axillary artery** and the main branch is called brachio-cephalic artery.

At the level of the 1st rib the brachio-cephalic artery gives the right axillary and the main artery is called bicarotid truck.

The left axillary artery is a branch of the common brachio-cephalic truck while the right one is a branch of brachio-cephalic artery.

Each axillary artery after its origin is directed forward beneath the trachea towards the thoracic inlet and reaches at the medial face of 1st rib. Each artery leaves the thoracic cavity by winding round the anterior border of the 1st rib to reach the axilla. It then bends downwards and backward in the axilla and reaches to the brachial plexus where it is suspended in the loop forward by muculo-cutaneous and median nerve.

Within the thoracic cavity each axillary artery gives off the following **intra thoracic branches.**

1. **Dorsal or Costo cervical artery:** It arises from the superior face of the artery & it run divides into-

a. **Dorsal scapular artery:** It gives of the 1st intercostals artery and supplies the muscles and skin in the dorsal region.

b. **Subcostal or intercostals artery:** It runs along the ventral aspect of the bodies of thoracic vertebra and gives off 2nd to 5t h inter-costals arteries.

2. **Vertebral artery:** It runs in the series of foramina transversarium from 6th cervical to3rd cervical vertebra and after that it enters into the spinal canal where it runs forwards connected by anastomotic branch to its fellow and divided into the ring of atlas into two branches inner and outer. Inner branch passes forward on the floor of canal as cerebrospinal artery unites with its fellow and assists in the formation of the rete mirabile cerebrali.
3. **Superficial cervical artery:**
4. **Internal thoracic artery:** It arises opposite the first rib and gives following braches.

a. **Musculo phrenic branch:** supplies to Intercostal muscles, transverse abdominis muscle & diaphragm.

b. **Cranial epigastric artery:** For rectus abdominis muscles.

Branches of Descending Aorta

The **descending** or **posterior aorta** is the and longer of the two terminal branches of the common aorta. This descending aorta can be divide into **thoracic** and **abdominal** parts.

A. Thoracic aorta: The thoracic aorta arises from the aorta arch ranging between 3rd to 6th cervical vertebra (depending on species). It gives of the following branches along its course.

S.No.	Arteries	Structures supplied
1	Bronchial branch-	
2	Oesophageal branch-	
3	Dorsal intercostals arteries-	
4	Phrenic branch -	

Practical No. 4

To study nerves of thorax

Q: Enlist nerves of thorax region?

Practical No. 5
To study the Lymphatic System

The lymphatic system is composed of lymph vessels and glands which are connected with the venous part of the blood vascular system.

Lymph: It is a clear intercellular fluid that is accumulated the intercellular spaces or tissue spaces.

Components of the lymphatic system:

(a) Lymphatics (small/large)
(b) Lymph nodes
(c) Major lymphatic ducts

Lymphatic vessels: These are the vessels either than blood vessels that carry the tissue fluid or the venous blood. These are very delicate structures and are present in all parts of the body except in the nervous system.

Lymphatic glands/lymph nodes: These glands are ovoid, spherical or discoid bodies of medium consistency, grey, rosy or red coloured, and sometimes quite black. They intercept the course of the lymphatic vessels at several points. Their number is considerable and they are rarely single, but most frequently are collected in groups along the blood vessels. The number of lymph nodes is variable, but these are constantly found in certain areas of the body as axilla, inguinal region, mesentery, pre scapular area etc.

Lymphocentre: this term is applied to a particular lymph node or a group of lymph nodes which are constantly present in a particular area of the body in a particular species of animal
e.g. parotid lymphocentre for parotid lymph node, mandibular lymphocentre for mandibular and pterygoid lymph nodes.

Location of lymph nodes:

(A) Thorax:

1. **Intercostals L.N.:** These lie along the inter-costals muscles.
2. **Anterior mediastinal L.N.:** These lie along the anterior vena cava and brachiocephalic trunk.

3. **Dorsal mediastinal L.N.:** These are situated on each side of thoracic aorta.
4. **Ventral mediastinal L.N.:** These are situated on the transverses thoracis.
5. **Posterior mediastinal L.N.:** These lie along the oesophagus.
6. **Middle mediastinal L.N.:** These are situated at the angle formed by the oesophagus and aorta.
7. **Bronchial L.N.:** It is situated between the aortic arch and pulmonary artery.
8. **Pulmonary L.N.:** These lie along chief bronchi.
9. **Pericardial L.N.:** It is situated between aortic arch and venahemiazygos.
10. **Sterna L.N.:** These are situated along internal thoracic vessels.
11. **Diaphragmatic L.N.:** It lies at foramen venaecavae.

Major lymphatic vessels/structures:

Cisterna chili: It is a dilated and elongated sac about (2-3inches in length)about 0.5 inches in diameter. It is located around the first lumbar vertebra placed to the right of the abdominal aorta on the right face of the crus of the diaphragm. It extends cranially to the thoracic cavity via the aortic hiatus of the diaphragm and continues as the thoracic duct.

Thoracic duct: It is the main lymphatic trunk which receives lymph from all parts of the body except from right side of the head, neck, thorax and right forelimb. About the level of the fourth intercostals space, it passes obliquely to the left surface of the oesophagus. It extends cranially and at the level of the first rib opens into the dorsal face of the left external jugular vein or anterior venacava.

Right lymphatic duct: It is a short trunk formed by the meeting of the terminal part of the right tracheal duct. This vessel collect lymph from the right side of the head, neck, thorax and right thoracic limb. It is the common duct formed by the efferentes of the superficial cervical lymph node with the lymphatic of the right tracheal lymphocentre. It opens either into the right common jugular vein or jugular confluent.

Tracheal duct: These are two in number, right and left. Each duct is formed by the union of the efferentes of the atlantal lymph gland. Then it passes down the neck in company with the internal jugular vein. At the lower part of the neck the left duct joins either the thoracic duct just a little in front of its termination or opens into the left common jugular vein, while the right tracheal duct goes to from the right lymphatic duct. Each tracheal

duct receives in its course the efferentes of the anterior, middle and posterior cervical, costo-cervical and prescapular lymph glands.

EXERCISE

Q: Draw schematic diagram of lymphatic.

Practical No. 6

TO STUDY TRACHEA OF OX, HORSE, DOG, PIG AND FOWL

The Trachea of Ox: It is a cartilaginous tube extending from the larynx to the hilus of the lungs where it is divides into right and left principal bronchi. It is kept permanently open by a series of **about 45-50 C shaped cartilaginous rings.** It occupies a median position except at its termination where it is pushed a little to the right of the median plane. Its average length is about 65 cm and width is about 3-4 cm. It is approximately cylindrical but its cervical part is depressed dorso-ventrally because of its contact with the longus colli muscle. The trachea has **cervical and thoracic parts.**

THE CERVICAL PART is related dorsally to the oesophagus for a short distance and for the rest of its extent to the longus colli muscle.

Laterally it is related to the lateral lobe of thyroid gland, common carotid artery, vagus and symphatic nerves, recurrent laryngeal nerves, tracheal lymph ducts and cervical lymph glands.

Ventrally it is related to the inferior cervical muscles. The sterno-cephalicus crosses it obliquely passing from the ventral surface forwards on its sides to reach the angle of jaws. The omohyoideus crosses the cervical part of trachea in its upper 3^{rd}. The sternothyro-hyoideus covers the ventral aspect of the trachea. This arrangement of **the muscles leaves a small area of the ventral surface of the trachea at its upper 3^{rd} covered only by the skin.**

THE THORACIC PART of the trachea passes between the pleural sacs and **divides into two bronchi opposite to the 5^{th} rib**. It is related dorsally to the longus colli muscles for short distance and beyond this to the oesophagus. Ventrally the trachea is related to the anterior vena cava, brachio – cephalic trunk, cardiac and recurrent laryngeal nerves.

The **trachea detaches about the level of the 3^{rd} rib/intercostals space, a small tracheal bronchus for the apical lobe of right lung** and beyond this it is adherent to the right lung.

Trachea of horse:

1. It is longer than the trachea of ox.
2. The **rings are** complete in the cervical parts and are **incomplete in the thoracic parts**.
3. The **rings are 50-60** in numbers.
4. It doesn't give any additional branch (Apical bronchi) to the right lung and is not adherent to the lung.

Trachea of Dog:

1. It contains **about 40-45 rings**.
2. Cartilaginous rings are 'C' shaped and incomplete dorsally.

Trachea of Pig:

1. It contains **32-35 rings**, which are **complete dorsally**
2. Apical bronchus is detached to the right lung, as in the ox.

Trachea of fowl:

1 The cartilaginous **rings are complete**.

2 It connects the cranial larynx and caudal larynx i.e. syrinx.

3. The **syrinx** is located at the bifurcation of the trachea. Between the bronchial openings there is a ridge called carina. On each side of this ridge is an elastic membrane i.e. internal tympaniform membrane. These structures, along with two lateral folds (external tympaniform membrane) produce slit like bronchial openings which is comparable to the rima glottidis of the mammalian larynx.

Practical No. 7

TO STUDY THE LUNGS OF OX, HORSE DOG, PIG AND FOWL

Lungs of Ox: The lungs are Right and Left. They occupy the greater part of the thoracic cavity. They are accurately adapted to the walls of the cavity and other intra thoracic organs. Each lung is soft, spongy and highly elastic. It crepitates when pressed between fingers and floats on water.

For the description each lung has two borders, two surfaces a base and an apex.

Surfaces:

a. Costal surface: is convex and lies against the thoracic wall and presents the impression of the ribs.

b. Mediastinal surface: is less extensive and presents a large concavity adapted to the pericardium and the heart and is termed as the cardiac impression. Above and behind this is the hilus of lungs at which the bronchus, pulmonary artery, pulmonary vein, bronchial artery, lymph vessels and nerve enter and leave the lung. Behind the hilus and slightly above it are two grooves – a dorsal one for the aorta and a ventral one for the esophagus, which is deeper in the left lung. Anteriorly there is a groove for the trachea, brachiocephalic trunk, the anterior venacava and the other vessels.

The intermediate or mediastinal lobe is found on the mediastinal surface of the right lung and is separated from the diaphragmatic lobe of the lung by a deep groove which lodges the posterior venacava and **the right phrenic nerve enclosed in a special fold of the pleura known as fold of venacava (Plica venaecavae).**

Borders:

1. **Dorsal border:** is long, thick and rounded.
2. **Ventral border:** is thin and short and presents at the level of heart, the **cardiac notch.** On the left lung this notch is opposite the 3-5/6 ribs from the 3-4th intercostals space. In right lung it is at 4th rib/inter costal space. **Apex** of the lung is prismatic, narrow and flattened transversally. It is marked off from the rest of lung by the cardiac notch. The apex of right lung reaches in front of the 1strib.

The **root** of the lung is composed of the structures which enter and leave the lung at the hilus on the mediastinal surface.

The base of lung is oval and deeply concave. It is adapted to the convexity of diaphragm.

The right lung is larger than the left. Each lung is divided into lobes by deep interlobular fissure. The left lung is divided into three lobes named from before backward, **Apical**, **Cardiac** and **Diaphragmatic**. The right lung has four lobes. The additional lobe is **intermediate/mediastinal.** In the right lung the apical lobe is much larger than the apical lobe of the left lung and occupies the space in front of the heart. It is further divided into anterior and posterior parts by the deep interlobular fissure.

Lungs of Horse:

1. The difference in the size of right and left lung is not so great as in the ox.
2. The lungs are **not separated into lobes** by deep fissures.
3. The right and left lungs consist of body and apex.
4. The intermediate lobe of right lung is separated from the rest of body by a groove for the **posterior venacava** and **right phrenic nerve.**
5. The two lungs are **adherent to each other** over a triangular area **behind the hilus** of the lung.
6. **Cardiac notch** is opposite to the **3-6th rib/intercostal s pace in left lung** and **3-4th intercostal space** in the right lung.

Lungs of Dog:

1. The lungs are distinctly divided into lobes as the fissures are very well formed even much better than the ox.
2. The right lung presents four lobes and the left lung has three lobes.
3. The cardiac impression is deeper on the medial face of the right lung than on the left.

Lungs of Pig:

1. The lobulation is distinct, but the interlobular septa are thinner than in the ox.
2. The right lung has 4 lobes as in the ox, while the left lung has 2 or 3 lobes.

Lungs of fowl:

1. They are small and occupy the dorsal part of the thorax. They are **intimately adherent to the ribs** and the costal impressions are deeper.
2. The **stem bronchus** enters the ventral surface of the lung about its middle. It continues caudally through the lungs and **opens into the abdominal air sac**. Within the lungs, this gives off **secondary bronchi which enter the cervical, clavicular and thoracic air sac.** Numerous **tertiary bronchi** radiate towards the periphery and **end blindly**.
3. **The air sacs** are thin walled sacs lined with mucous membrane and covered

by serous membrane. They all forms communications with the bronchi and the interior of most of the long bones. **There are 11 sacs named as cervical, clavicular, axillary, anterior thoracic, posterior thoracic and abdominal.** All are paired except the clavicular.

EXERCISE:

Question 1: Draw the well labelled diagram of dorso- lateral view of the lung of ox.

Practical No. 8

To study the surgical anatomy of tracheotomy.

Indications- Threatened respiratory failure on account of allergy or other obstructions of the upper respiratory tract like edema of the larynx, upper lip and nostrils, and in hemorrhagic septicemia.

Anaesthesia and Restraint- Local infiltration in lateral recumbency or in standing position.

Site- The midline on the ventral aspect of the neck at the junction of its upper and middle thirds. In this area the trachea on the midline is covered by skin, sub-cutaneous connective tissue and the loose fascia between the two sternothyrohyoideus muscles.

Palpable region for trachea-

Shape and number of tracheal rings in :

Animal	No.	Shape
Ox-		
Horse-		
Dog-		
Camel-		
Fowl-		

Tracheotomy-

Practical No. 9

To study the surgical anatomy of oesophagotomy

Indications- Oesophageal obstruction or diverticulum

Course of oesophagus-

Relations of oesophagus at the level of 4th cervical vertebra-On left side-

On right side-

Dorsally-

Tunics of the wall of the oesophagus-

State the boundaries of jugular furrow-

Contents of the jugular furrow-

Anaesthesia and Restraint- Local anaesthesia in lateral recumbency

Site- Either at the point of obstruction or at the lower border of jugular furrow along the jugular vein if the obstruction is just inside the thorax.

- The oesophagus is soft on palpation but its position is evident when the animal swallows.
- In the wall of the oesophagus, the serosal layer is absent and the mucosa is easily separable from muscular tunic. This is important while suturing the wall (the two layers be sutured separately).

Practical No. 10

To study the anatomical site for the thoracocentesis (Paracenetesis thoracis).

Boundaries of thoracic cavity-

Dorsal-

Ventral-

Lateral-

Anterior-

Posterior-

Contents of thoracic cavity-

Structures passing through the thoracic inlet-

Openings of the diaphragm-

Indications of thoracotomy - Severe respiratory distress in moist pleurisy, collection of fluid for diagnostic purposes i.e. in hydrothorax, hemothorax, pyothorax etc.

Anaesthesia and Restraint- Local anaesthesia in standing position

Site for thoracocentesis in:

Animal	Right	Left
Ox		
Sheep/Goat		
Horse		
Pig		
Dog		

- Thoracocentesis is performed at anterior border of rib, as the nerve is present at the posterior border.
- Instruments- Trocar and canula, 6 inches long and 1/8 inches in diameter or a 14-16 gauze and 6 inches long needle.

Structures penetrated from external surface to reach thoracic cavity-

The extent of heart in:

Ox

Sheep/Goat

Horse

Pig

Dog

Features of mediastinum in:

Ox

Horse

Dog

Practical No. 11

Lumbar Vertebrae: -

Short bodies

Expanded transverse processes

Identification of Species: -

Ox:-

These are six in numbers

Horse:-

These are also 6 in number

The spines are higher.

Dog:-

These are 7 in number.

Pig:-

These are six or seven in number.

Muscles of Back and Loin

S.No.	Name of Muscle	Origin	Insertion	Action
1	First layer 1 Trapezius thoracalis 2 latissimus dorsi			
2	Second layer Rhomboideus thoracalis	Spinous process of the 2nd to 7t h thoracic vertebrae	Medial surface of cartilage of scapula	To draw the scapula upward and forward
3	Third layer Serratus dorsalis anterior (anticus)	Lumbo-dorsal fascia and dorsa-scapular ligament	Lateral surface of the 5th /6th 11th/12th ribs	To draw the ribs on which it is inserted forward and

	Serratus dorsalis posterior (posticus)	Lumbodorsal fascia	The lateral surface of the last 7^{th} or 8^{th} ribs	outwards and thus helps in aspiration. To draw the ribs backward and thus helps in aspiration
4	Fourth layer Longissimus costarum	Lumbar part: arises from the external angle of the ileum and lumbar transverse process.	Posterior border of the last rib.	To assist in expiration.
		Costal part: Anterior border and	Posterior border of the rib from 1^{st} to 10^{th} and to	
	Longissimus dorsi	Lateral surface of the last 8 or 9 ribs. 1.Tuber crest and adjacent part of ventral surface of ileum 2. First three sacral spine 3. lumbar and thoracic spine	the transverse process of last cervical vertebrae Transverse and articular process of lumbar vertebrae Transverse process of thoracic vertebrae The spinous and transverse process of the last four cervical vertebrae	Act as extensors of back

5	Fifth layer Levator costarum Multifidus dorsi	Transverse process of thoracic vertebrae. Lateral sacral crest, oblique process of the lumbar vertebrae and transverse process of thoracic vertebrae.	Anterior border and lateral surface of rib. Spinous process of sacral, lumbar And thoracic vertebrae.	To assist in expiration. To extend the lumbodorsal spine (together) To flex the lumbodorsal spine on one side. (singly)

Muscles of Abdomen

S.No.	Name of Muscle	Origin	Insertion	Action
1	Obliquus abdominis externus	Lateral surface of the rib behind the fourth and the fascia over the external intercostal muscle	1. Linea alba and prepubic tendon 2. Tuber coxae and shaft of ileum.	To compress the abdominal viscera i.e. in micturation. Parturition and expiration. Acting singly, to flex the trunk laterally
2	Obliquus abdominis internus	Tuber coxae and adjacent part of inguinal ligament	1.Cartilage of last4-5 ribs 2. Linea alba and prepubic	To compress the abdominal viscera i.e. in micturation.

			tendon	Defication parturition and expiration. Acting singly, to flex the trunk laterally.
3	Rectus abdominis	Cartilage of 4^{th} /5^{th} to 9^{th} ribs and adjacent part of sternum.	Pubis, by means of prepubic tendon.	Same as above
4	Transverses abdominis	1. Medial surface of ventral ends cartilages of asternal rib. 2. Transverse process of lumbar vertebrae.	Xyphoid cartilage and linea alba.	Same as above.

Practical No. 12

Abdominal aorta: The branches of the abdominal aorta are-

1. Celiac artery
2. Anterior/cranial mesenteric artery
3. Renal arteries
4. Posterior/caudal mesenteric artery
5. Spermatic arteries (in male)/ utero-ovarian arteries (in female)
6. Lumber arteries
7. Internal iliac arteries
8. External iliac arteries

Coeliac artery: It is the largest and unpaired artery arises from inferior face of aorta. It divides into following branches in ruminants.

Sl. No.	**Arteries**	**Structures supplied**
1	Hepatic artery-	
a)	Pancreatic artery-	
b)	Gastro duodenal artery-	
i)	Pancreato duodenal branch-	
ii)	Right gastro epiploic branch-	
c)	Cystic artery-	
(d)	Right gastric artery-	
2	Right ruminal artery-	
(a)	Splenic artery-	
3	Left ruminal artery-	
(a)	Reticular artery-	

4	Omaso abomasal artery-	
(a)	Anterior omasal artery-	
(b)	Right abomasal artery-	

In simple stomach animals coeliac artery is divided into gastric, hepatic and splenic arteries.

Cranial mesenteric artery: It is the second branch of the abdominal aorta. It arises from posterior to the coeliac artery.

Sl. No.	**Arteries**	**Structures supplied**
1	Pancreatic artery-	
2	Middle colic artery-	
3	Ileo ceco colic artery-	
4	Ramus collaterals-	
5	Jejuna artery-	
6	Ileal artery-	

The other branches of the abdominal aorta are -

Sl. No.	**Arteries**	**Structures supplied**
1	Renal artery-	
2	Posterior mesenteric artery-	
3	Spermatic artery-	
4	Utero-ovarian artery-	
5	Lumbar artery-	

Internal iliac artery: This artery arises from abdominal aorta at the level of the 5th or 6th lumbar vertebra. The collateral branches are-

Sl. No.	**Arteries**	**Structures supplied**
1(a)	Umbilical artery-	
(b)	Vesical artery-	
(c)	Middle uterine artery-	
2	Ilio- lumber artery-	
3	Anterior/cranial gluteal artery-	
4	Urogenital artery- **In male**	
(a)	Differential branch-	
(b)	Prostatic artery-	
(c)	Urethral artery-	
	In female	
(a)	Cranial branch	
(i)	Caudal vesicular artery-	
(ii)	Urethral branch	
(b)	Caudal branch-	
(i)	Branch to clitoris and vestibule-	
(ii)	Dorsal perineal artery-	
(iii)	Caudal rectal artery	
(iv)	Caudal labial branch	

5	Posterior/caudal gluteal artery	
6	Obturator branch	
7	Internal pudendal (pudic) artery-	
	In male	
(a)	Caudal rectal artery-	
(b)	Ventral perineal artery-	
(c)	Artery of penis-	
	In female	
(a)	Branch to vagina and vestibule	
(b)	Ventral perineal artery	
(c)	Artery of clitoris-	

External iliac artery: It supplies blood to the hind limb.

After giving the external iliac artery the abdominal aorta is continued as middle sacral artery. At the level of the 1st coccygeal vertebra, it is continued as the middle coccygeal artery which supplies the tail.

EXERCISE

The arteries used to record pulse rate in different species:

1. Ox : _____
2. Sheep and goat : _____
3. Horse : _____
4. Pig : _____
5. Dog : _____
6. Fowl : _____

Practical No. 13
Location of lymph nodes of Abdomen

(a) Visceral L.N.

i) Ruminal L.N.

1. **Atrial L.N.:** It is situated on the right face of atrium ventriculi behind cardia.
2. **Left ruminal L.N.:** These lie along the left longitudinal groove of rumen.
3. **Right ruminal L.N.:** These lie along the right longitudinal groove of rumen.
4. **Anterior ruminal L.N.:** It lies in anterior transverse groove of rumen.
5. **Reticular L.N.:** It lies at reticulo-omasal junction.
6. **Omasal L.N.:** These lie along the greater curvature of omasum.
7. **Abomasal L.N.:** These lie along the concave curvature of abomasums.

ii) Hepatic L.N.: It lies in portal fissure.

iii) Pancreatic L.N.: These are situated on inferior face of pancreas.

iv) Intestinal L.N.:

1. **Duodenal L.N.:** These lie the mesoduodenum
2. **Jejuno-ileal L.N.:** These lie in the fold of mesentery along visceral border.
3. **Colic L.N.:** These lie between the coils of the colon.
4. **Rectal L.N.:** These lie along the superior and lateral face of rectum.
5. **Renal L.N.:** These lie along renal vessels.

(b) Parietal L.N.:

1. **Lumbar L.N.:** These lie along abdominal aorta and posterior venacava.
2. **Celiac L.N.:** These lie near celiac plexus.

Practical No. 14

TO STUDY THE STOMACH OF OX, HORSE, DOG AND PIG:

Stomach of ox:

The stomach is the most dilated part of the alimentary canal.

Position: It occupies the ¾ of the abdominal cavity. Except the small space left for the spleen, kidney, liver and pancreas and coils of small intestine.

The stomach of ox is compound type and consists of four divisions viz Rumen, Reticulum, Omasum and Abomasum. The first three divisions are regarded as the proventriculioftheoesophagus.Theyarelinedwithnon-glandularstratifiedsquamous (cornified) epithelium. The fourth compartment i.e. Abomasum, is the true stomach and is lined by the glandular mucous membrane.

Rumen (Paunch): It forms the 80% of the total stomach capacity and occupies left half of the abdominal cavity. It extends between the diaphragm (8^{th} rib) to the pelvic inlet. It has two surfaces, two curvatures or borders and two extremities.

Surfaces: The surfaces are marked by left and right longitudinal grooves, which indicate externally the division of rumen in to dorsal and ventral sacs.

1. The Parietal (left) surface is related to the spleen, diaphragm and left abdominal wall.

2. The Visceral (right) surface: is related to the omasum, abomasum, intestine, liver, pancreas, left kidney, aorta, celiac artery and posterior venacava.

Extremities:

Reticular extremity or Anterior extremity is divided ventrally by a transverse anterior groove into two sacs, dorsal and ventral. Pelvic or posterior extremity is also divided into dorsal and ventral blind sacs by the transverse posterior groove, which connects the longitudinal grooves. The blind sacs are marked off from the remainder of the rumen by the dorsal and ventral coronary grooves.

Curvatures:

The **dorsal curvature** follows the curve formed by the left part of the crura of diaphragm and the sublumbar muscles. The **ventral curvature** lies on the floor of the abdomen.

Interiorly; corresponding to each groove similarly named **pillars** are present which divide the rumen into various scas.The mucous membrane of the rumen is brown in colour except on the pillars where it is yellow. It is for the most part studded with large papillae. The edges of the chief pillars and large part of the wall of the middle of the dorsal sacs, are however non-papillated. The papillae are best developed in the blind sacs.

The rumen and reticulum together form a dome like vestibule dorsally called **atrium ventriculi** on which the esophagous terminates.

Reticulum (Honey comb):

The reticulum is the most anterior and smallest of the four divisions. It forms only 5% of the total capacity of stomach. It is pyriform in shape. It lies opposite the $6^{t\,h}$ to 8^{th} rib. It lies against the diaphragm almost in the median plane.

Surfaces:

The parietal or diaphragmatic surface: It faces forward and lies against the diaphragm and liver.

Visceral and ruminal surface: faces backward and it ends dorsally by joining the wall of rumen.

Curvatures:

The lesser curvature faces to the right and dorsally and is connected with the omasum.

The greater curvature faces to the left and lies against the diaphragm.

The mucous membrane of reticulum forms 4-6 sided cells i.e. honey comb of various orders (I, II, III). At the reticulo-omasal orifice there are peculiar curved horney papillae which resemble the claws of a small bird hence they are termed as **ungulifrom papillae**.

Reticular/Oesophageal groove begins at the cardia and passes ventrally on the medial wall of the atrium ventriculi and reticulum to end at the reticulo-omasal orifice. The groove is twisted in a spiral fashion. The mucous membrane of the lips of the reticular groove is brown and wrinkled. In the bottom of the groove it is pale and marked by longitudinal folds.

Omasum (Maniplies):

The omasum constitutes about 7-8% of the total stomach capacity and lies Entirely to the right side of the median plane opposite the 7^{th} to11^{th} ribs. It has two surfaces (parietal and visceral) and two curvatures (greater and lesser). The cavity of the omasum is occupied by about 100 longitudinal folds known as laminae omasi, which spring from the greater curvature and the sides and reaches to the lesser curvature. On either side of long primary folds, there is a second order and third order laminae. Numerous rounded horny papillae stud the surface of the laminae. The floor of the omasum has a groove, the **sulcus omasi** which connects the reticulo-omasal opening with the omaso-abomasal opening. It functions as the direct path from reticulum to the abomasum.

Abomasum:

It is an elongated piriform sac, lies on the right side of the median plane on the abdominal floor opposite the 7-12th rib. For description it presents two surfaces and two curvatures. The anterior extremity is known as the fundic extremity and the posterior extremity is known as pyloric extremity. Internally the abomasums is divided by a construction into two areas.

The first part i.e. **fundic region** is lined with as of glandular mucous membrane which forms dozen or more extensive spiral folds known as Plica spirales. The second part i.e. **pyloric region** is much narrower. The omaso-abomosal orifice is bounded in front by the thick muscular pillar. Towards the duodenal openings, mucous membrane forms extensive folds over the raised mount like structure,the

torus pylorus. It acts as valves, which prevents regurgitation of the contents of abomasum.

Stomach of horse:

1. It is simple (single) stomach.
2. It is relatively and comparatively much smaller than that of ox and its capacity is about 10-20 liters only.
3. It is sharply **curved J-shaped**, the right part being very much shorter than the left one.
4. It is situated in the dorsal part of the abdominal cavity behind the liver and the diaphragm, mainly towards the left of the median plane. The parietal surface lies against the diaphragm and liver. The visceral surface is related to the terminal part of the large colon, the pancreas the small colon, the small intestine & the greater omentum.
5. The left extremity forms a rounded a cul-de-sac and is known as **Saccus-caecus**.
6. The oesophageal orifice of the stomach is known as cardia, opening of stomach into duodenum is known as pylors.
7. Internally the mucous membrane is clearly divided into two (oesphageal and glandular) parts and the line of demarcation is known as **margoplicatus**. There is change in colour and texture of the mucous membrane. The oesophageal part is white in colour and is free of any glands. The glandular part has soft and velvety appearance and is covered by mucoid secretion. It contains the gastric gland.
8. The glandular part is further divided into cardiac, fundic and pyloric regions.

Stomach of dog:

1. It is simple stomach. It is irregularly pyriform in shape.
2. Its average capacity (in adult large sized dog) is about 3.5 to 4liters.
3. It is present towards the left side of the median plane in the abdominal cavity and is relate to the liver and the diaphragm.
4. Internally the mucous membrane is glandular throughout. The cardiac glands are present only around the cardia.
5. Nearly 2/3rd of the extent of the mucous membrane is thick and has the fundic glands.Remaining1/3rdis the pyloric mucous membrane, which is thin and has the pyloric gland.

Stomach of Pig:

1. It is simple and large.
2. The left part is large while the right part is small and bends sharply upward to join the small intestine.
3. The left extremity presents a flattened conical blind pouch known a s diverticulum ventriculi.
4. A sharp line demarcats the nonglandular oesophageal region from the glandular region.

EXERCISE :

1. Draw the well labelled diagram of stomach of cow, dog, horse and fowl.

2. Draw the well labelled diagram of different components of stomach.

Practical No. 15

TO STUDY THE SMALL INTESTINE OF OX, HORSE, DOG AND PIG.

Intestine of Ox: It is about 20 times the length of body. It is attached to the sub lumbar region by common mesentery.

Intestine has two parts: small intestine and large intestine.

Small Intestine of Ox: It comprises of duodenum, jejunum and ilium.

It begins at the pylorus and terminates at the caecum. Its average length is about 39-42 meter and its diameter about 5 to 6 cm.

Position: It lies almost entirely at the right side of the median plane.

It is divided into two parts, Fixed and Mesenteric parts.

Duodenum: Is about 90 to 120 cm.

1. The first passes dorsally and forward to the visceral surface of the liver, here it forms a „S‟ shaped curve i.e. Ansasigmoidea.
2. The Second part runs backward to the tuner coxae, where it turns on itself forming iliac flexor.
3. The third part extends forward along side of the terminal part of the colon and joins the mesenteric part at jejunum under the right kidney.

**The bile duct opens in the ventral part of the „S‟ shaped curve. The pancreatic duct opens about 30 cm further back.

Jejunum and Ilium: are arranged in numerous very close coils, which form a sort of festoon at the edge of the mesentery. It lies chiefly in the space bounded medially by the right face of the ventral sac of the rumen, latterly and ventrally by the abdominal wall, dorsally by the large intestine and anteriorly the omasum and abomasums.

Internally, the mucosa is thrown into permanent transverse folds except in the region of the ilium, where it is in the form of a longitudinal fold. The **duodenal glands** or **(Brunner's glands)** are present in the duodenum and 2.4 to 3.3 meters of jejunum. The **Payer's patches** are situated chiefly along the surface opposite to the mesenteric

attachment and begin 90-120 cm from the pylorus. Their number in adult is 18-40 and in the calves 20-58.

Small Intestine of horse:

1. Small intestine is placed in the left half of the median plane. Its average length is about 21-21.6 meters and capacity is 40-50liters.
2. Duodenum is **horse shoe** shaped.
3. 12-15 cm from the pylorus, the mucous membrane form a pouch known as **Diverticulum duodenii** in which pancreatic and hepatic ducts open.
4. Jejunum and ilium forms numerous coils mingled with colon.
5. The duodenal glands are present in first 6 meters instead of 3.5 to 4.5 meters as in the case of ox.
6. The Peyer's patches are not as distinct and prominent that in the ox.

Small Intestine of dog:

1. It occupies most of the abdominal cavity behind the liver and stomach.
2. The **bile duct** and the smaller **pancreatic duct** open in the duodenum about 5-8 cm from the pylorus. The larger pancreatic duct opens 2-5 cm further back.
3. Duodenum glands occur only close to the pylorus.

Small Intestine of pig: Intestine is about 15 times the length of the body.

1. Bile duct opens in duodenum 1 or 2 inches from the pylorus and pancreatic duct about 4 or 5 inches behind it.
2. Peyer's patches are band like and very distinct.

EXERCISE :

1. Draw a well labelled diagram of small intestine of cattle, horse, dog and fowl.

Practical No. 16

TO STUDY THE LARGE INTESTINE OF OX, HORSE, DOG AND PIG.

Large Intestine of Ox: It comprises of caecum, colon and rectum. It is approximately 11.4 meters long and extends from the termination of the Ilium to the anus.

Position: Most of the part is situated in the right dorsal part of the abdominal cavity.

Caecum: It is about 75 cm long and 12 cm in diameter. The demarcation is the junction of ilium with the large intestine, which is on the medial side and usually near the ventral end of the last rib. The Caecum extends backward and upward along right flanks and its blind end commonly lies on the right side of the pelvic inlet. It is attached along its medial side to the mesentery except posterior third, which is free and variable and position. The dorsal surface it attached by peritoneum to the colon.

Colon: It is about 10 meters in length.

Various parts of colon: 1. ***Ansa proximale:*** It begins as a direct continuation of Caecum & later on joins the spiral mass.

2. ***Ansa spirales:*** The greater part of colon is arranged in double elliptical coil which makes 2 ½ round and are alternately centripetal and centrifugal between the layers of mesentery. It gradually diminishes in caliber.

3. ***Ansa destalis:*** Terminal part of the colon leaves the spiral mass, passes forward to the anterior mesenteric artery and runs backwards dorsal to the terminal part of the duodenum.

4. ***Ansa sigmodea:*** Colon forms and S-shaped curve near the pelvic inlet and joins the rectum. This part is attached to the sublumbar region by a fold of mesentery i.e. **mesocolon**.

Rectum: It is the terminal part of the bowel and extends from the pelvic inlet to the anus. Its length is about 30 cm. The **peritoneal part** (till about the level of first coccygeal) of the rectum is attached to the mesentery i.e. **mesorectum.**

The **retroperitoneal part** forms a flask shaped dilatation known as **ampulla rectii**.

Large Intestine of Horse: It is about 7.5 - 8 meters in length and is divided into Caecum, great colon, small colon and rectum.

Caecum: Average length is about 120 cm and capacity is about 30-35 liters. It is **comma shaped** sac. It present a base (posterior end), a body and an apex (anterior end).

The base is large and strongly curved. It is blind at both extremities but has two orifices, Ilio-caecal and Caeco-colic placed close together 50-75 mm apart at the concave curvature of its base.

The body extends downward and forward from the base and rest on the ventral wall of the abdominal.

The apex lies on the abdominal floor to the right side of the median plane about 10 cm behind the xiphoid cartilage and terminates at a point.

The caecum has four longitudinal folds called as **Taenia caeci;** these cause 4 rows of sacculation called as **Haustra caeci.**

Great Colon: It begins at the caeco-colic orifice and terminates by joining the small colon behind the saccus-caecus of the stomach. It consists of four parts.

Ist part, the right ventral colon begins at the lesser curvature of the base of caecum. Over the xiphoid cartilage it bends sharply to the left and backward forming the **Sternal Flexur.**

IInd part, the right ventral colon passes backward from the abdominal floor and on reaching the pelvic inlet, bends sharply dorsally and forward, forming the **Pelvic Flexur.**

IIIrd part, the left dorsal colon passes forward and on reaching the diaphragm and left lobe of liver, turns to the right and backwards forming the **Diaphragmatic Flexur.**

IVth part, the right dorsal colon joins the small colon below the left kidney.

Small Colon: It begins at the termination of great colon behind the saccus caecus of the stomach and ventral to the left kidney and continued by the rectum. Its length is

about 3-4 meters. It presents characteristics two longitudinal bands and two rows of sacculations i.e. **Taenia coli, Haustra coli.**

Rectum: It is larger than that of ox.

Large intestine of Dog: It has no bands or sacculations.

Caecum is 12-15 cm in length and flexuous.

Colon presents three parts, **ascending**, **transverse** and **descending.**

Rectum: It is covered with peritoneum. The line of peritoneum reflection begins under The 2^{nd} or 3^{rd} coccygeal vertebrae. At the junction of rectum and anus the mucous membrane has a **stratified sqamous epithelium** and contains the **glands**. A small opening on either side leads into two **lateral anal sacs.** The skin which lines these pouches contains the **coiled tubular glands.** Further, back the skin contains **large sebaceous** and peculiar **circumanal glands** – the **Anal glands.** As the **ilium** doesn't open in the **caecum** but in the colon directly, Hence **ilio-colic orifice** is present and the **ilio-caecal orifice** is absent.

Large Intestine of pig:

Caecum:

1. It is cylindrical and its dorsal end i.e. directly continued by the colon.

2. It has 3 longitudinal muscular bands 4-3 rows of sacculations

Colon:

1. Most of it is arranged in 3 close, double spiral coils in the mesentery.

2. Spiral colon has 2 bands and 2 series of sacculations.

EXERCISE :

1. Draw a comparative structure of large intestine of different animals.

Practical No 17

TO STUDY THE LIVER OF OX, HORSE, DOG AND PIG

Liver of Ox: It is the largest gland in the body and lies **entirely on the right side** of the median plane. Its average weight is 2.7-5.4 kg. In fresh stage it is brownish in colour. Its consists of two surfaces and two borders.

Surfaces:

1. Parietal surface is convex and most of the part applied to the right side of the diaphragm, but small part of it is in contact with the last two to three ribs and with the flank at the lumbo-costal angle.

2. Visceral surface is concave and very irregular and presents **omasal** and **reticular impressions.** It is also related to the **duodenum** and the **pancreas.** A well defined rounded depression is present dorsal to the omasal impression known as **portal fissure** through which the portal vein, hepatic artery and hepatic plexus of nerve enter and the hepatic duct and lymph vessels leave the liver.

Borders:

1. Dorsal border is short and thick. It presents the large thick quadrilateral caudate lobe and a deep impression for the right kidney i.e. **renal impression.**

2. Ventral border is short and thin and has no interlobular incisures.

3. Right border is marked by the **umbilical fissure** in which ligamentum teres is attached in the young subjects.

4. Left border present **oesophageal notch** below is middle. Above it lodges the posterior venacava, which is embedded in the organ.

Ligaments of the liver:

1. Right lateral ligament attaches the dorsal border to the anterior part of the sublumber region.

2. Round ligament of liver/ligamentum teres extends from the umbilical fissure to the umbilicus. It is the vestige of the umbilical vein, which in the featus caries the blood from the placenta to the liver.

3. Lesser omentum attaches liver to the stomach.

4. Falciform ligament attaches the parietal surface of liver to the sternal part of diaphragm and abdominal floor.

5. Caudate ligament/hepato -renal ligament extends caudate lobe to the ventral surface of right kidney.

Gall Bladder: It is a pear shaped containing bile. It lies partly in contact with the visceral surface of the liver, but largely against the abdominal wall at the ventral part of the $10^{th}/11^{th}$ intercostals space. It is regarded as the **diverticulum of the bile duct** and meant for the storage of bile. Its neck is continued by the cystic duct which joins the hepatic duct just outside of the portal fissure, to form the bile duct.

Liver of horse:

1. Gall bladder is absent.
2. Liver is more extensive than that of ox. The greater part of it lies on the right side of the median plane but it **also extend to the left side** of the median plane.
3. Visceral surface is concave and irregular, molded on the organ which lies against it. It presents the following features:-

(a) The portal fissure – A dispression above the middle of the surface. (b) The **gastric impression** for the stomach. (c) The **duodenal impression**. (d) The **colic impression** for diaphragmatic flexure and right dorsal part of the colon. (e) A **caecal impression**.

4. The dorsal border present from right to the left ; (a) the right lateral ligament, (b) renal impression,(c)a notch at the dorsal end of the venacava, (d) the deep oesophageal notch, (e) the left lateral ligament.

5. The ventral border is marked by the deep interlobular fissures which divide the liver into **three principal lobes, right, middle and the left.**

6. There are **six ligaments** of the liver instead of five as in the case of ox. **The additional ligament is the left lateral ligament**.

Liver of dog:

1. The liver of dog is relatively large.

2. It is divided into **five lobes** by fissures, which converge at the portal fissure.

a) The left lateral lobe- the largest.

b) The left central lobe – smallest and prismatic.

c) The right central lobe – second in size and presents a tongue shaped quadrate lobe.

d) The right central lobe is third in size.

e) Quadrate lobe.

3. The gall bladder lies in the fossa between the two parts of right central lobe.

4. On its visceral surface is the large caudate lobe, which consists of the right caudate process and the left papillary process.

Liver of pig:

1. It consists of **four principal lobes.**

(a) Right lateral, (b) Right central, (c) Left central, (d) Left lateral(largest lobe).

2. On the upper part of the visceral surface of right lateral lobe, is the caudate lobe.

3. Visceral surface is deeply concave to accommodate the stomach. **No renal impression exists**, as the right kidney doesn't touch the liver.

4. The fossa for the gall bladder is mainly on the right central lobe.

5. Neither lateral nor caudate ligament are present.

EXERCISE :

1. Draw a well labelled diagram of liver of ox, horse, dog and fowl.

Practical No. 18

TO STUDY THE SPLEEN OF OX, HORSE, DOG AND PIG.

Spleen of Ox: It is the largest ductless gland in the body.

Position: It is situated on the left face of the rumen.

Shape: It is elliptical in outline.

In fresh stage it is bluish red or purple in colour. Its average weight is about 1/6% of the total body weight. For description it presents two surfaces, two borders and two extremities.

Surfaces:

1. Parietal surface is convex and is applied against the diaphragm. A narrow, triangular, elongated area of parietal surface close to the anterior border, has no peritoneal covering as it is directly attached to the diaphragm.

2. Visceral surface: is concave and is related to the left side of the dorsal sac of the rumen. Nearly half of the visceral surface has no peritoneal covering as it is directly attached to the dorsal sac of the rumen. Close to the anterior border, upper third of the visceral surface present hilus, which transmits the vessels and nerves of the spleen?

Border:

1. Anterior border: is concave and thick.

2. Posterior border: is convex and thin.

Extremity:

1. Dorsal extremity: usually lies under the proximal end of last ribs.

2. Ventral extremity: is variable in position and usually lies under the lower third of 8^{th} rib. It is attached to the left face of the rumen and left crus of the diaphragm by peritoneum and connective tissue.

Spleen of horse:

1. It is **sickle shaped**.

2. The visceral surface is divided into two unequal parts by a longitudinal ridge. On this surface the **hilus** is present.

3. Attachments: a) peritoneal fold.

b) Suspensory ligament of the spleen.

c) Gastrosplenicomentum.

Spleen of dog:

1. It **is falciform** in shape.

2. It is bright red in colour.

3. Its parietal surface is convex and lies against the left flank.

4. Visceral surface is marked by a longitudinal ridge on which vessels and nerves are situated and Greater omentum is attached.

Spleen of pig:

1. It is long and narrow. Its long axis is nearly dorso- ventral indirection

2. Visceral surface is marked by a longitudinal ridge on which the hilus is situated; divides the surface into gastric and intestinal areas which are in contact with the stomach and colon respectively.

3. The parietal surface is convex and is related to the left lateral and ventral abdominal wall.

4. The spleen is attached very loosely to the stomach.

EXERCISE :

1. Draw a well labelled diagram of spleen of ox.

Practical No. 19

TO STUDY THE PANCREAS OF OX, HORSE, DOG AND PIG.

Pancreas of ox:

Shape: It is irregularly **quadrilateral** in form

Position: Lies entirely to the right side of the median plane.

In fresh stage it is reddish cream in colour but if left in unpreserved condition, it rapidly decomposes and become dark brown. For description it presents two surfaces and four borders.

Surfaces:

1. Dorsal surface: It is upward and is related to the liver, right kidney, crura diaphragm, posterior venacava, coeliac and mesenteric arteries. It is covered to a large extent by peritoneum.

2. Ventral surface: It is backward and ventrally it is in contact with the dorsal curvature of the rumen and intestine.

Borders:

1. Right border: It is nearly straight and related to the second part of the duodenum.

2. Left border: It is small.

3. Posterior border: Presents notch for the portal vein and hepatic arteries and several lymph glands are present.

4. Anterior border: It is somewhat straight.

The pancreatic duct is formed by the union of radical branches. It leaves the posterior part of the right border and enters into the duodenum, a farther back than the bile duct.

Pancreas of horse: It is triangular in outline and presents two surfaces, three borders and three angles.

Surface:

1. Dorsalsurface: It is partially covered by peritoneum. It is related to the right kidney, adrenal, posterior venacava, portal vein, right and caudate lobes of the liver, gastropancreatic fold and coeliac artery.

2. Ventral surface: It is marked by an oblique ridge. It is related to the right side of the base of the caecum and left side of the terminal part of the great colon.

Border:

1. Posterior border: It presents a **deep notch** where the root of the great mesentery is in contact with the glands.

2. Right border: It is straight and is related to the 2nd part of the duodenum.

3. Left border: It is slightly concave and is related to the 1st part of the duodenum, left sac of the splenic vessels.

Angles:

Three angles:

a) Anterior/duodenum angle.
b) Left (splenic) angle.
c) Right angle.

Pancreas of dog:

1. It is **V-shaped** consisting of two long narrow branches which meet at an angle behind the pylorus.
2. There are **two pancreatic ducts**. Smaller one opens into the **duodenum** with the bile duct and large one opens into the **bowel.**

Pancreas of pig:

1. It is triangular or triradiate
2. The pancreas extends across the dorsal wall of the abdominal cavity behind the stomach

EXERCISE :

1. **D**raw a well labelled diagram of pancreas of ox and fowl.

Practical No. 20

TO STUDY THE DIGESTIVE SYSTEM OF FOWL

Mouth:

1. The cavum oris is triangular.
2. Vestibule is absent.

Lips and Cheeks: The lips and cheeks are absent.

Hard palate:

1. It is narrow and triangular.
2. Anteriorly there is a median ridge and posterior a median slit communicates with the nasal cavity. A lateral ridge extends from the median ridge posterior, to the whole length of the palate.
3. On either side of the **median ridge** are the openings of the **maxillary glands**. On either side of the **lateral ridges** are the openings of the **medial and lateral palatine glands**.
4. Behind the median ridge are **5 transverse rows of horny pointed papillae** directed backwards. The most posterior one marks limit of the mouth cavity.

The Soft Palate is absent.

The tongue:

1. It is narrow and **triangular** and the **apex is pointed** in front.
2. Muscular tissue is very little.
3. The root is crossed by a row of pointed horny papillae.

Teeth are absent.

The salivary glands:

1. The **maxillary glands** lie in roof of the mouth and they open on either side of the median ridge of the hard palate.
2. The **palatine glands** are medial and lateral and open on either side of the lateral ridges.

3. The **mandibular glands** lie between the two halves of the mandible and their ducts open on the floor of the mouth by several ducts.
4. A **small round gland** near the angle of the mouth is regarded as the **parotid salivary glands.**

These glands are all in the sub mucous tissue and produce a mucous floor.

The stomach:

1. It is made up of **two parts- a glandular proventriculus and muscular gizzard**.
2. The **proventriculus** is an elongated fusiform thick walled tubular organ, which lies on to the left side related laterally and ventrally to the liver and the spleen at its supero-posterior aspect. It is connected in front with the oesophagus and behind with the gizzard.
3. The **gizzard or muscular stomach** is a dense thick walled muscular disc with two orifices lying close together on the anterior dorsal aspect of its circumference. It is situated behind, partly between the two lobes of the liver. The mucous membrane lining the gizzard is thrown into ridges and is covered by dense horny substance.

Small Intestine: It is made up of duodenum, jejunum and ileum.

1. The **duodenum** leaves the gizzard, passes backwards to the right and forms a loop, the flexure being at the posterior part of the abdominal cavity.
2. It continous forward past its origin to be continued at **jejuno-ileum coiled** between the abdominal air sacs.
3. The **two bile ducts and two pancreatic ducts** empty near each other at the termination of the duodenum.

Large Intestine: It consists of the **two caecae** and the colon. The line of demarcation between the ileum and the colon is at the opening of the caeca. The **colon is short and straight**, leading from the ileum to the cloaca.

The caeca are two blind sacs about 7 inches long. They empty into the intestines at the junction of the ileum and colon.

The cloaca is a tubular structure opening on the exterior, and is the **common opening for the digestive, urinary and genital systems.** It is divisible into three parts:

1. The **coprodeum,** into which the colon empties.

2. The **urodeum,** into which the ureters and genital ducts open.

3. The **proctodeum,** the last portion**,** through which an opening leads from the dorsal wall to the **bursa of fabricius** – a blind sac like unpaired lymphoid structure. It is well developed in chicken at about four months of age. It usually disappears at one year of age.

EXERCISE :

1. Draw a well labelled diagram of digestive system of fowl.

Practical No. 21

TO STUDY THE KIDNEY OF OX, HORSE, DOG AND PIG

Kidney of Ox:

The kidneys are two, elongated elliptical red brown glandular organs situated retroperitoneally in the sublumbar region. Their surface is marked by numerous fissures dividing it in to polygonal lobes; about 20 in number. The weight of each kidney is about 500-700 gm. The left kidney is slightly heavier and shorter. They are embedded in a large amount of sublumbar (perirenal) fat. The right and left kidneys vary in form and position.

Right kidney: It presents two surfaces, two borders and two extremities.

Position: Lay ventral to the last rib and the first two or three lumbar transverse processes.

The dorsal surface is rounded and is related to the sublumbar muscles.

The ventral surface is less convex and is related to the liver, pancreas, duodenum and colon. The hilus is situated at the anterior part of this surface nearer to the medial border.

The medial border is nearly straight and lies parallel to the posterior vena cava.

The lateral border is convex.

The anterior extremity is thick and lies in the **renal impression of the liver** and is related to the adrenal. **The posterior extremity** is narrow and pointed.

Left kidney:

Position: It is variable is position. When the rumen is full, it is pushed slightly to the median plane, then it is below the bodies of the third, fourth and fifth lumbar vertebrae. When the rumen is not so full it may lie slightly towards the left.

Surfaces: **Three surfaces**.

The **dorsal surface** is convex and is related to the bodies of the lumbar vertebrae and sublumbar muscles. **The ventral surface** is less convex and is related to the intestine.

The lateral surface is flattened due to its contact with the rumen and is hence termed the **ruminal surface**.

The medial border is nearly straight and is related to the abdominal aorta and ureter. The hilus is situated on the antero- lateral aspect of the dorsal surface.

The right kidney is more firmly fixed that the one due to its fixation in to the renal impression and hepato renal ligament of the liver.

Structure: The kidneys are covered by a strong capsule of fibrous tissue. A section of the kidney reveals that it is made up of an outer reddish brown – **cortex** and an inner light coloured- **medulla**. **The cortex** presents a granular appearance and is studded with numerous minute dark points the renal or malpighian corpuscles, which are the dilated origins of the renal tubules containing a tuft of capillaries the glomerulus.

The medulla is in the form of pyramids or renal pyramids (20 in number) with their bases directed towards the cortex. Between the pyramids a part of the cortex dips forming the renal columns of Bertin. Each renal pyramid presents radially striated appearance. It presents at its apex-the renal papilla. Each renal papilla is embraced by the funnel shaped calyx minor, which opens into a larger calyx major. Two such calyces majores unite at the hilus to form the excretory duct ureter.

Kidney of Horse:

1. The surfaces are smooth and are not lubulated.
2. The right kidney resembles the heart of playing cards while the left is bean shaped.
3. The right kidney is situated under the vertebral ends of the last two ribs and first lumbar transverse process. The left one is under the last rib and the first 2 or 3 lumbar transverse processes.
4. The hilus is at about the middle of the medial border of each kidney.
5. The hilus leads into a **renal sinus** in the interior, for the lodgement of the renal pelvis which is the dilated origin of the ureter. The inner central part of the medulla forms a concave ridge – the **renal crest** which is the result of fusion of renal papilla. It presents numerous openings - the **area cribrosa** through which the larger renal ducts open into the renal pelvis.
6. Renal pyramids are not very prominent.

Kidney of Dog:

1. The kidneys are nonlobulated.
2. Both kidneys are bean shaped.
3. Right kidney is situated opposite the bodies of the first three lumbar vertebrae. Anterior half lies in the renal impression of the liver.
4. Left kidney is loosely attached by peritoneum and is affected by degree of fullness of the stomach. When the stomach is empty, it lies against the 2^{nd}, 3^{rd} and 4^{th} lumbar vertebrae so that its anterior pole may be opposite the hilus of the right kidney. When the stomach is full, it lies one vertebra further back.

Kidney of Pig:

1. Kidneys are bean shaped having a smooth convex surface without lobulation.
2. Both kidneys are almost symmetrically placed under the transverse processes of the first four lumbar vertebrae, but the left kidney is often a little further forward than the right one.
3. In sections: renal pyramid are distinctly seen.

EXERCISE :

1. Draw a well labelled diagram of kidney of ox, horse, dog, pig and fowl.

Practical No. 22

TO STUDY THE URETER, URINARY BLADDER AND URETHRA OF OX, HORSE, DOG AND PIG

Ureter of Ox:

The ureters begin at the junction of the calyces majores and terminate at the bladder. It is about 0.5 cm in diameter.

The **right ureter** emerges out of the hilus of the right kidney from its ventral surface, runs medial to reach the medial border and runs along it.

The **left ureter** emerges out of the hilus on the antero- lateral aspect of the dorsal face, crosses over this face medially, gains the internal border and runs caudad.

Each ureter consists of abdominal and pelvic parts.

The **abdominal part** runs caudad and mediad, the right ureter is related to posterior vena cava, while the left is to the aorta. The ureter pass caudally in the sub-peritoneal tissue on the ventral surface of the psoas muscles, cross the external iliac artery and enter the pelvic cavity.

The **pelvic part** passes caudally and ventrally on the lateral wall of the pelvic cavity, turns medially and pierces the dorsal wall of the bladder near the neck. In the **male** the pelvic part enters the genital fold and crosses vas deferens. In the **female** it is situated in most of its course in the dorsal part of the broad ligament of the uterus.

Ureter of Horse:

1. Each ureter begins at the renal pelvis instead of junction of calyces majors as in the ox.
2. Both the ureters leave the kidney at the hilus and curve caudally and medially towards the lateral surface of posterior venacava (right side) or the aorta (left side).

Ureter of Dog: It resembles that of the horse.

Ureter of Pig: It is relatively wide towards origin and gradually diminishes in diameter.

Urinary bladder of Ox:

It is a musculo-membranous sac, which differs in form, size, and position according to the amount of its contents. When empty, it is a dense pyriform mass about the size of a fist and lies more or less in the abdominal cavity. When moderately full, it is oval in shape and lies clearly on the abdominal floor.

The bladder has three parts:-

1. **Vortex:** It is an **anterior blind end**. On its middle It is marked by a mass termed as **cicatrix** which is the vestige of the **urachus**. **URACHUS** forms a connection between the bladder and the allantois in the foetus.
2. **The body or middle part** is rounded and somewhat flattened from above downwards.Itpresentstwosurfaces–dorsalandventralwhichareconvexwhen full.
3. The **neck** is posterior part and it joins the urethra.

Relations: Vary according to the amount of the contents and sex.

The ventral surface is related to the floor of the pelvis and extends into the abdomen as it distends. In the male, the dorsal surface is related to the rectum, genital fold, the terminal part of the vas deferens, vesicular gland and prostate.

In females, its dorsal surface is in contact with the body of uterus and vagina. The vortex of bladder is related with the coils of intestines.

Fixation: The displacement of bladder is limited by three peritoneal folds, one middle and two lateral ligaments. The neck is fixed in position by its connection with the urethra.

Ligaments:

1. The **middle ligament** is the triangular fold formed by the reflection of the peritoneum from the ventral surface of the bladder on to the ventral floor of the pelvis and abdomen.

2. The **two lateral ligaments** stretch from the lateral aspect of the bladder to the lateral pelvic wall. Each contains in it, a round firm band, known as **round ligament, which** is the remnant of the large **foetal umbilical artery**.

The posterior retroperitoneal part of the bladder is attached to the surrounding parts by loose connective tissue and fat.

The mucous membrane forms numerous folds when the organ is empty andcontracted. It is modified dorsally over a triangular area near the neck, termed the **trigonum vesicae.** Here the mucous membrane is firmly attached and does not form folds. The two anterior angles of this area present the openings of the two ureters and the posterior angle shows the internal urethral orifice.

Urinary bladder of Horse:

1. It is shorter but wider.
2. When empty and contracted it lies on the ventral wall of the pelvic cavity.

Urinary bladder of Dog:

1. It is relatively larger.
2. When empty, it is entirely pelvic and when fully extended, it is abdominal and vortex may reach to the umblicus.
3. It is completely covered with peritoneum.

Urinary bladder of Pig:

1. The bladder is relatively very large. When full, it lies chiefly in the abdominal cavity.
2. Dorsal surface is almost completely covered with peritoneum.

Practical No. 23

TO STUDY THE TESTICLES AND APPENDAGES OF OX, HORSE, DOG AND PIG

The Scrotum of Ox:

It is a long pendulous diverticulum of the abdomen which lodges the testicles and its appendages.

Position: It is situated in front of the inguinal region.

Shape: It is oval and slightly compressed from side to side.

Structure: It is composed of the following layers –

1. **Skin:** the outermost layer which is marked by a central raphe – the **raphe scroti**.
2. **Dartos:** the fibro – elastic tissue which also forms a **septum scroti;** dividing the scrotal cavity into two unequal parts. The left cavity is larger than the right one.
3. **Scrotal fascia:** three layers of which are derived from oblique and transverse abdominal muscles. (i) Inter-columnar fascia, (ii) Cremasteric fascia, (iii) Infundibuliform fascia.
4. **The tunica vaginalis:** the inner most layer which forms a fibroserous sac and is continuous with the peritoneum.

The Scrotum of Horse:

Position: In the inguinal region.

Shape: Globular

The Scrotum of Dog:

Position: behind the inguinal region.

The raphe is not distinct.

The Scrotum of Pig:

Position: in perineal region.

Testicles of Ox:

The testicles are two tubular glands situated in the scrotum suspended by the spermatic cords. The long axis of these is vertical (dorso-ventral) and each is slightly compressed from side to side. It presents two surfaces, two borders and two extremities.

The **external (lateral) surface** is convex and smooth and the **internal (medial) surface** is slightly flattened due to its contact with the septum scroti.

The **free border** is anterior and is convex.

The **attached border** is posterior and is called epididymal border. It is nearly straight.

The **superior and inferior (caudal) extremities** are rounded.

The left testis is heavier than the right.

Structure: The testicles have two coverings, the **tunica vaginalis** and **tunica albugenia.** The tunica vaginalis is a flask shaped serous sac, the inferior part of which covers the testicles and the epididymis. It is narrowed dorsally into a canal and contains the spermatic cord. It is an evagination of the parietal peritoneum of the abdomen during the descent of the testicles. It consists of two layers, **parietal** and visceral layers.

The parietal layer is called **tunica vaginalis communis/reflexa** which lines the inguinal canal in the scrotum. The visceral layer is called **tunica vaginalis proprius** which covers the testicle, epididymis and spermatic cord except along the line of the attachment of the epididymis and at the proximal extremity where the testicular vessels and nerves enter the gland.

Next to the tunica vaginalis is the tunica albugenia, which forms a strong thin capsule of fibro elastic tissue. Descending from the attached end, passing deep into the gland and extending from the proximal to the distal extremity is a strand of highly vascular connective tissue processes termed as **mediastinum testis.** From this connective tissue trabeculae known as **septulae testis** arise, which divide the parenchyma of testis into a number of lobules known as **lobulitestis.**

Epididymis: It is attached along the posterior border of the testic les and slightly towards the lateral surface. It presents three parts.

1. **Head:** The superior enlarged part**.** It is closely adherent to the superior end of the testicle.
2. **Body:** The middle part. It is narrow and lies along the lateral posterior border of the testicle.
3. **Tail:** The lower part**.** It is large and is attached to the inferior end of the testicle by the ligamentum epididymis. It is continued by the vas deferens.

The gland is covered externally by the tunica vaginalis proprius.

Spermatic cord: The spermatic cord consists of structures which suspend the testicle in the scrotum. It begins at the internal inguinal ring where all the structures come together, passes through the inguinal canal, passes over the side of the penis and ends at the attached border of the testicle. It consists of the following structures:-

1. Testicular artery.
2. Testicular veins.
3. Spermatic nerves.
4. Testicular lymphatics.
5. Internal cremaster muscle.
6. Vas deferens.
7. Tunica vaginalis.

Of these, the former four are gathered into a rounded mass united by connective tissue and separated by the cremaster muscle. They form the anterior vascular part of the cord. The vas deferens forms the posterior nonvascular part. It is enclosed in a special fold of tunica vaginalis.

Testicles of Horse:

1. They are relatively smaller but globular.
2. The long axis lies anteroposteriorly.
3. The free border is ventral and the attached border is dorsal.
4. Tunica albuginia is thick and contains unstripped muscles fibres.
5. A distinct Mediastinum testis doesn’t exist.

Testicles of Dog:

1. The testicles are relatively small and oval.

2. Long axis is obliquely directed upward and backward.
3. Mediastinum testis is well developed.
4. The epididymis lies along the superior border.

Testicles of Pig:

1. Testicles are very large and elliptical.
2. Their long axis is directed upward and backward.
3. The epididymis lies along the ventral border.

EXERCISE :

1. Draw a well labelled diagram of testis of ox, horse, dog and fowl.

Practical No. 24

TO STUDY THE ACCESSORY GENITAL GLANDS OF OX, HORSE, DOG AND PIG

Accessory genital glands of ox:

1. **Vesiculae Seminalis (Vesicular gland):** These are two compact glandular organs, which are lobulated in appearance.

Position: It lies on each side of the posterior part of the dorsal surface of the urinary bladder.

They are partially enclosed in the genital fold and related dorsally to the rectum. They are about 10-12 cm long, 4-6 cm wide and 2-3 cm in thickness. The dorsal surface is covered by peritoneum. The excretory duct dips under the body of the prostate and opens on either side of the colliculus seminalis, just lateral to the opening of ductus deferense.

2. **Prostate gland:** It is pale yellow in colour and consists of two parts, the **body and pars disseminata** which are continuous with each other.

Position: The body stretches across the dorsal surface of the neck of the bladder an the origin of urethra. The pars disseminata surrounds the pelvic part of the urethra. It is concealed by urethral muscle and its aponeurosis. The 15-20 prostatic ducts open into the urethra in two rows caudal to the colliculus seminalis.

3. **Bulbourethral or Cowper's gland:** These are two ovoid glands about the size of areca nut. They are covered by thick fibrous tissue and bulbocavernosus muscle.

Position: On either side of the pelvic part of the urethra close to the ischial arch. Each has single duct, which opens in the urethra.

Accessory genital glands of horse:

Seminal vesicles:

1. These are two elongated pyriform sac with a fundus, body and neck.
2. The duct joins the vas deferense and open on by a common ejaculatory orifice.

Prostate gland:

1. It consists of two lateral lobes, connected by isthmus.
2. The pars disseminata is absent.
3. The lateral lobes are prismatic inform.
4. A thin transverse band joins the junction of the neck of the bladder with the urethra.

Bulbourethral gland:

1. They are relatively larger than the ox.

Accessory genital glands of dog: Only Prostate gland is present in dog

1. It is very large, globular and surrounds by the neck of the bladder.
2. A median furrow indicates a division into two **lateral lobes**. The ducts are numerous.
3. Pars disseminata completely embedded in urethra.

Seminal vesicle and Bulbourethral gland are absent.

Accessory genital glands of pig:

1. Seminal vesicles are very large three sided pyramidal glands extending even into the abdominal cavity.
2. Prostate resembles that of ox.
3. Bulbourethral glands are very large and dense.

Practical No. 25

TO STUDY THE GENITAL SYSTEM OF COW, MARE, BITCH AND SOW

The female genital system consists of -

1. The two ovaries.
2. Uterine/ Fallopian tube or oviduct
3. The uterus
4. Vagina
5. Vulva
6. Mammary gland (accessory organ)

Genital system of cow:

1. Ovaries:

Shape: It is pale in colour oval in shape and pointed at the uterine end.

Size: The size varies in different animals and even in the same animal in different seasons. They are generally larger in younger animals than in the older animals. One ovary is usually larger than the other. They are about 30-40 cm long, 2-2.5 cm in width and 1-1.5 cm thick. It has two surfaces two borders and two extremities.

Surfaces: are medial and lateral. Both are smooth and rounded.

Borders: The attached border known as **mesovarian border** is enclosed in the part of a broad ligament termed as **mesovarium**. The vessels and nerves reach the gland at this border. The other border is the free border.

Extremities: The anterior extremity is rounded and related to the fimbriated end of the uterine tube. The posterior extremity is pointed and is connected to the horn of uterus by the ovarian ligament.

Position and fixation: The ovaries are situated usually near the middle of the lateral border of the pelvic inlet, cranial to the iliac artery in the non-pregnant animals but may slide further cranial especially in the pregnant cows. The ovary is attached to the upper part of the flank 15-20 cm below the level of the tuber coxae by the anterior part of the **broad ligament of the uterus**. The uterine extremity of the ovary is connected with the extremity of the cornu of the uterus by a **ligament of the ovary**.

2. Oviduct/Uterine/Fallopian tubes: These are **flexuous tubular** structure (20-25cm long), extending from the extremities of the uterine cornua to the ovaries. They receive ova from the ovaries and convey it to the cornu uteri. The tube is small at its uterine end but towards the ovary it widens considerably forming the **ampulla tubae.** Each is enclosed in a peritoneal fold derived form the lateral layer of the broad ligament and termed as the **mesosalphnix**. It largely covers the lateral aspect of the ovary and forms with it and the broad ligament a pouch known as **bursa ovarica**. The uterine extremity of the tube communicates with the cornua of the uterus by a minute orifice, **ostium uterinum tubae**. The ovarian extremity is expended and funnel shaped termed as **fimbrae.** The fimbrae ovarica are attached to the ovary. Rest of it part are attached to the free margin of the **bursaovarica**. In the middle of the infundibulum there is a small opening the **ostium abdominale tubae** by which it communicates with the peritoneal cavity.

The ovarian extremity of the tube is normally applied to the ovaries, so that the extruded ova pass directly into it and then are conveyed to the uterus.

3. Uterus: The uterus is a hollow muscular organ, which communicates with the uterine tube anteriorly and opens into the vagina psoteriorly. It is attached to the upper part of the flank about 15-20 cm below the level of the tuber coxae by two folds of the peritoneum termed the **broad ligament**. Uterus comprises of two horns (cornua), a body and a cervix.

a. The horn/cornua of the uterus are situated entirely in the abdomen. The posterior part of the cornua remains united by connective and muscular tissues. It has a common peritoneal covering. The cornua are therefore more extensive than they appear externally and have an average length of 35-40 cm. They taper gradually towards the junction with the uterine tube. The cornua describe an “S” shaped or a spiral coil by running FODBLU (forward outward downward backward laterally then upward).

b. The **body (corpus)** of the uterus is cylindrical and flattened dorso- ventrally. Its average length is only 2.5-4 cm, although externally it appears to be about 2.5-15 cm long. The false impression is due to the fact that the posterior parts of the cornua are united by a connective tissue and muscular tissues covered by a common peritoneum. Its dorsal surface is related to the rectum and intestines. Its ventral surface is in

contact with the bladder. The term **fundus uteri** is applied to the wide anterior part from which the cornua diverge.

c. The **neck (cervix)** of the uterus is the constricted posterior part, which joins the vagina. It is about 10 cm long. Part of it projects in the cavity of the vagina **PORTIO VAGINALIS** therefore it is not visible externally but may be felt through the vaginal wall. The vaginal part is fused ventrally with the vagina so that **fornix vagina** is formed (2-3 cm deep) dorsally, and is absent ventrally. The lumen of the cervix called the **cervical canal** is spiral or "S" shaped tightly closed. It is difficult to dilate. cervix is clearly marked off from the body of the uterus and the vagina. Os externum opens in the vagina and Os internum opens in to the corpusuteri.

The mucous membrane of the horns and body presents characteristic uterine cotyledons whereas in the cervix it forms branched cervical folds-palm leaf shaped (plicae palmatae).

4. Vagina: The vagina is musculo membranous tubular passage which extends through the pelvic cavity from the neck of the uterus to the vulva. It is about 10-12 inches long (in the non-pregnant animals) and 4-5 inches in the diameter. It is extensively dilatable and appears to be only limited by the pelvic walls. There is no line of demarcation between the vagina and vulva externally. It is related dorsally to the rectum, ventrally to the bladder and the urethra and laterally to the pelvic wall. The recto- genital pouch of the peritoneum extends between the vagina and the rectum for a distance of about 12-15cm. Ventrally the vesico-genital pouch passes caudally far about 5-6 cm between the vagina and the bladder. Thus most of the vagina is **retroperitoneal** and is surrounded by loose connective tissue, venous plexus and variable amount of fat.

In the ventral wall of the vagina, between the mucous and muscular coats, two **canals of Gartener** (embryonic vestigs) are present. They open psoteriorly near the external urethral orifice.

5. Vulva: It is continous in front with the vagina and opens externally at the vulvar cleft, 5-8 cm below the anus. It is about 10-13 cm in length measured from the external urethral orifice to the ventral commisure. It is related dorsally to the rectum and anus, ventrally to the pelvic floor, laterally to the sacrosciatic ligament, the

Semi-membranosus muscle and the internal pudic artery. The external orifice, the vulvar cleft has the form of a vertical slit about 12-15 cm high and is margined by two wrinkled lips known as labium vulvae. These meet above and below at acute angles forming the dorsal and ventral vulvar commisures. At the ventral commisure there are long hairs. When the labia are drawn apart, a round body about 2-2.5 cm wide is seen occupying the cavity in the ventral commisure, known as glans clitoridis which is the homologue of the glans penis (of male). The cavity in which it lies is known as **fossa clitoridis**. At the anterior extremity of the ventral wall of the vulva about 10-12.5 cm from the ventral commisure is the external urethral orifice, which has the form of a longitudinal slit (about 2.5 cm long). Beneath it; is a blind pouch, the **suburethral diverticulum**.

Clitoris: The clitoris is **homologue of the penis** and consists of similar parts. The **corpus clitoris** is about 5 cm long and its diameter is about <1 cm. It is attached to the ischial arch by **two crura**. The body is 10-13 cm long. The **glans clitoridis** is rounded and enlarged free end of the organ which is visible in the ventral commisure of the vulva. A thin pigmented integument, the **prepuce of the clitoris**, covers it.

Genital System of Mare:

Ovaries:

1. The ovaries are bean shaped (7-8 cm long 2.5-3 cm wide and 50-90 gm in weight).

2. The free border is marked by a notch, known as **ovulation fossa**. The ovulation fossa is covered by the **germinal epithelium**.
3. They are situated in the sublumbar region, usually below the 4-5th lumbar vertebrae.

Fallopian tube:

1. These are 20-25 cm in length.
2. The fimbriae ovaricae are attached in the ovulation fossa.
3. They are more flexuous.
4. Their connection with the cornua is very abrupt.

Uterus:

1. The uterus is attached to the sublumbar region and lateral wall of the pelvic cavity by the broad ligament.
2. It is partly in the abdominal and partly in the pelvic cavity.
3. The cornua are 25 cm in length and are not coiled as in case of cow.
4. The junction of the uterine tube with the horn of uterus is abrupt.
5. The average length of the body of the uterus is 16-20cm.
6. The cervix is about 5-8 cm in length.
7. The mucous membrane has no cotyledons.

Vagina:

1. It is about 15-20 cm in length.
2. The fornix vagina is complete dorsally and ventrally.
3. Gartener‟s canal is absent.

Vulva:

1. The ventral commisure is rounded and without long hair on it.
2. The suburethral opening is wide and dilatable.

Genital System of Bitch:

Ovaries:

1. These are small flattened elongated oval glands.
2. Each ovary is situated behind or in contact with the caudal pole of the corresponding kidney and thus lies opposite to the 3-4$^{t h}$ lumbar vertebrae.
3. The right one lies caudal to the right part of the duodenum and the lateral abdominal wall and the left one is related to the spleen.
4. Each ovary is concealed in a peritoneal pouch, known as bursa ovarii.
5. There is **no distinct hilus**.

Fallopian tube:

1. These are about 5-8 cm in length.
2. It is slightly flexuous.
3. The fimbriated extremity lies chiefly in the bursa ovarii but part of it often protrudes as a slit like opening of the bursa.
4. It has large abdominal opening.

5. The uterine orifice is very small.

Uterus:

1. The uterus has a very small **body** but extremely long and narrow **horns.**
2. The **horns** are uniform in diameter, **straight** and lie entirely in the abdominal cavity.
3. They diverge from the body in the form of word **"V" towards** each kidney.
4. The **neck** is very short and has a thicker muscular coat.
5. Cotyledons are absent.

Vagina:

1. It is relatively long.
2. It has no distinct fornix.
3. The canals of gartner are absent.

Vulva:

1. The labia are thick and form a pointed inferior **commisure.**
2. The glanduli vestibulars majores are absent but small glands are often present and their ducts open ventrally by a sort of isthmus.
3. The body of the clitoris is broad and flat and about 2.5-4.5 cm long in a median size bitch.

Genital System of Sow:

Ovaries:

1. Ovaries are more rounded and have a **distinct hilus**.
2. The ovaries are concealed in the bursa ovarii.
3. The surface presents rounded prominences, so that the gland has an **irregular lobulated appearance**; the projections are large follicles and corporalutea.

Uterine/fallopian tubes:

1. The fimbriated extremity forms an ampulla and has a large abdominal opening.

Uterus:

1. The body is only 5 cm long.

2. The horns are extremely long (1.2 – 1.5 m) and flexuous and are freely movable.
3. The **neck is very long (10 cm) and it is directly continued by the vagina without forming any intravaginal projection.**
4. Cervical canal is occluded by rounded prominences, which are continuous caudally with folds of mucous membrane of vagina.

Vagina:

1. It is about 10-12 cm long.
2. It has a thick muscular coat.

Vulva:

1. Labia are thick and are covered with a wrinkled skin.
2. The dorsal commisure is rounded, but ventral one form a long pointed projection.
3. There is a deep central depression between the fossa clitoridis and the external urethral orifices.
4. Clitoris is long and flexuous.

EXERCISE :

1. Draw a well labelled diagram of female genitalia of ox, horse, dog and fowl.

Practical No. 26

TO STUDY THE MAMMARY GLANDS OF COW, MARE, BITCH AND SOW

Mammary glands of Cow: These are four modified cutaneous (sweat) glands are and termed as **udder**.

Position: On either side of the median plane in the prepubic region.

Each is ellipsoidal in form. **The base** of the gland is slightly concave and slopes obliquely ventro dorsally and is attached to the abdominal wall by the strong fibro-elastic **suspensory apparatus**, is attached to the symphysis pelvis by means of a strong sub pelvic tendon tissue.

The **suspensory apparatus** consists of four sheets of tissue, two of which are well developedandmedianinposition.Thesearechieflycomprisedofyellowelastictissue. The two glands are separated by **double (median) septum**, which is attached to the medial, flat surface of each gland. The **lateral sheets** containing less elastic tissue arise from the subpelvic tendon posterior to the udder. On reaching the abdominal floor they diverge and pass laterally to the **external inguinal ring.** They extend downward over the udder and **divide into superficial and deep layers**. The superficial layer attaches to the skin where it reflects off the udder to the medial face of the thigh. The deep layer is thicker and attaches to the convex lateral surface of the udder by numerous laminae, which pass to the glands. Posteriorly it is in relation to the large **supramammary lymph gland.** The lateral surface is convex.

The udder consists of **four quarter** but there is no visible division between the two-quarter of the same side. Each quarter consists of glandular mass or the body of the gland and a teat. Four well developed teats are present (about 6-10 cm long). Each teat has a single lactiferous duct, **the teat canal,** which widens superiorly opens into a roomy **lactiferous sinus/milk cistern**. Each lactiferous duct is lined by glandless mucous membrane. The lower part of the canal is narrower and is closed by sphincter.

Mammary glands of Mare: There are two teats. On the apex of each teat there are two orifices.

Mammary glands of Bitch: They are usually 10 in number and are arranged in two series extending from the inguinal to the pectoral region. They are designated

according to their location i.e. pectoral, abdominal and inguinal. The teats are short and present 6-12 orifices of the teat canal on their apices.

Mammary glands of Sow:

They are **10 or 12** in number and are **arranged in two rows**, as in bitch. Each teat has commonly two ducts.

EXERCISE :

1. Draw a well labelled diagram of mammary gland of ox.

Practical No. 27

TO STUDY THE URO-GENITAL SYSTEM OF FOWL

URINARY SYSTEM:

Kidney:

1. Kidneys are two, they lie along each side of the vertebral column from the vertebral end of the 6th rib into the iliac fossa.
2. It is **elongated** in shape.
3. Each is made up of **three or four lobes** and is dark red in colour.

Ureter:

1. The ureter is white in colour and arises on the anterior part of the ventral surface of the kidney, runs caudally in relation to the vas deferens or oviducts.
2. Each ureter opens into the urodeum of the cloaca internal to the opening of vas deferens or oviduct.

Urinary bladder: Absent in fowl.

GENITAL SYSTEM:

Male genital:

Scrotum: It is absent as **testicles are abdominal** in position.

Testicles:

1. The testicles lie ventral to the anterior lobes of respective kidneys.
2. The right one is against the dorsal part of the right lobe of liver while the left one is related to the glandular stomach.
3. They are bean shaped and bear on the concave border a flattened projection – the rudimentary epididymis

Vas deferens: The vas deferens are extremely tortuous ducts which arise from the epididymis, pass caudally and open into the urodeum on the summit of a papilla lateral to the opening of the ureter.

Accessory sex glands and Urethra: Absent.

Female genital system:

Ovary:

1. Only **left ovary** is present. Right ovary usually disappears.
2. The ovary is situated in the dorsal part of the abdominal cavity, attached to the dorsal wall **opposite the last two ribs.**

Oviduct:

Only the left oviduct is developed. It is a dilatable convoluted tube, about 80cm in length in laying hen, and extends caudally against the dorsal part of the left body wall in relation to the ilium and ischium. It opens into the urodeum of the cloaca lateral to the left ureter. It is suspended between two layers of a fold of peritoneum which forms the membranous **dorsal and ventral ligaments of the oviduct.** The ventral border of the dorsal ligament is attached to the oviduct, while its dorsal border is attached to the dorsal body wall. The ventral ligament has a free ventral border which is thick and muscular.

The anterior end of the oviduct has a delicate funnel shaped structure with long processes reaching the ovary. Entrance to the oviduct is a slit like opening, the oviduct ends into the cloaca.

The oviduct may be divided into five parts.

1. **The infundibulum:** Is 2-3 cm long funnel shaped structure, with delicate walls. Its functions are to grasp the ovum as it is released from the ovary.
2. The **magnum:** Albumin secreting part forming the major part of the duct and is about 40 cm long. It is remarkable for the thickness of the wall. It secrets about 40% of the albumen of the egg.
3. **The isthmus:** Is about 12 cm long, connects the albumen region with a thinner walled uterus. The lumen is narrow and secretes the shell- membrane and some albumen.
4. **The uterus:** Thin wall or “shell gland” containing part. It is wide and about12cm long. Its termination is guarded by sphincter muscle. The function is to secrete about 40% of the total egg albumen and to form the calcareous shell.
5. **The vagina:** Is 12 cm long. It succeeds the sphincter of uterus. It is very muscular. The outer shell cuticle and perhaps pigment are formed in this part. It terminates in the cloaca.

EXERCISE :

1. Draw a well labelled diagram of ovary and oviduct of fowl.

Practical No. 28

Objective- To study the anatomical site for the abdominocentesis/ laprocentesis (Paracenetesis abdominis).

Boundaries of abdominal cavity-

Dorsal-

Ventral-

Lateral-

Anterior-

Posterior-

Abdominal tunics-

Divisions of abdominal cavity-

- Transverse planes pass through last thoracic and 5^{th} lumbar vertebra.
- Sagittal planes pass through mid point of inguinal ligament.

Openings of the abdominal cavity-

Write in ox topographic position of:

Rumen-

Reticulum-

Omasum-

Abomasum

- Spleen-

Liver-

Gall bladder-

Small intestine-

Large intestine-

Boundaries of paralumbar fossa in ox-

Define-

Flank-

Linea alba-

Prepubic tendon-

Inguinal/ Poupart's ligament-

Peritoneum-

Peritoneal cavity-

Omentum-

Mesentery-

Ligament-

Indications of abdominocentesis- Ascities, collection of fluid samples for diagnosis and other purposes (Peritoneal fluid).

Anaesthesia and Restraint- Local anaesthesia in standing position.

Site- Lateral to and in front or behind the level of umbilicus.

Instruments- Trocar and canula, size- 6 inches long and 1/8 inches in diameter or a 14-16 gauze 6 inches long needle.

Precautions-

Practical No. 29

Objective- To study the anatomical structures of the abdominal wall in relation to various surgical implications.

Name the structures of the abdominal wall, in order from without inwards during the surgical operations:

In the upper flank region in ox –

In the paracostal approach laterally in ox-

In the region under and along the contour of the thigh in ox-

In the paramedian incision in ox-

In the post xephoid crescentric incision in ox-

In the paramedian approach anterior to the umbilicus in dog-

In the paramedian approach posterior to the umbilicus in dog-

The external layer of the rectus sheath is formed in; Horse and ox by-

Dog;

Cranial to the umbilicus by-

Caudal to the umbilicus by-

The internal layer of the rectus sheath is formed in; Horse and ox by-

Dog;

Cranial to the umbilicus by-

Caudal to the umbilicus by-

Practical No. 30

Objective- To study the anatomical site for rumenocentesis (Puncture of rumen) in ox.

Indications- In acute tympany (to relieve gas), direct medication in to the rumen.

Anaesthesia and Control- Local anaesthesia in standing position. In emergency without anaesthesia.

Site- Center of the left flank.

Special instruments- Trocar and canula

Write in order structures pierced during rumenocentesis-

Nerve supply to the rumen-

Blood supply to the rumen-

Boundaries of paralumbar fossa-

Precautions-

Practical No. 31

Objective- To study the surgical anatomy for rumenotomy.

Indications- Ruminal impaction, foreign-body syndrome, recurrent tympany, diaphragmatic hernia, exploratory rumenotomy, impaction and atony of omasum or abomasums etc.

Anaesthesia and Restraint- Paravertebral nerve block or local infiltration in inverted 'L' shape in standing position.

Site- Left paralumbar fossa, parallel to the last rib.

Special instrument- Weingart's rumenotomy set (frame and hooks) and Vulsellum forceps.

Procedure- A 15-20 cm long skin incision is given commencing from the upper boundary of left paralumbar fossa and running parallel to the last rib. Then muscles are incised keeping the length of the muscular incision slightly shorter than the skin incision. After this the rumen is exposed by incising the peritoneum. Rumen is then exteriorized and fixed to the cutaneous incision with the help of Weingart's rumenotomy frame, Vulsellum forceps and hooks. A stab incision is given in the rumen and the gas is removed, the incision is then extended with the help of scissors. The scalpal and the scissors used to incise the rumen are then discarded. The rumen is evacuated manually upto$3/4^{th}$ of its capacity, the inside of the rumen and reticulum is explored and any foreign body if present is removed. The rumen is closed using lambert and cushing sutures, then Weingart's rumenotomy set is removed. The muscles are sutured in two layers and the peritoneum is sutured along with the internal layer. The skin is sutured by simple interrupted or horizontal mattress sutures.

Structures involved in rumenotomy in order-

Rumenotomy-

Rumenostomy-

Interior of rumen-

Interior of reticulum-

Capacity of rumen-

Capacity of reticulum-

- In camel the rumenotomy is done in sternal recumbency.
- Presence of traumatic foreign bodies in the rumen may cause traumatic reticulitis or traumatic reticuloperitonitis.
- The rumen is evacuated only to $3/4^{th}$ of its capacity to preserve ruminal microflora.

Practical No. 32

Objective- To study the surgical anatomy of the cystotomy in dogs.

Indications- Urinary bladder stone (cystolith), cystic tumor, for biopsy of bladder, following a traumatic rupture of bladder (cystorrhaphy) **Anaesthesia and control-** General anaesthesia in dorsal recumbency.

Site- A mid-ventral approach is used through linea alba. In the male dog, the prepuce is reflected laterally to allow opening of the linea alba.

Procedure- After incising through the skin and linea alba the bladder is exteriorized and brought to the incision. Moistened laprotomy towels are placed around the urinary bladder to prevent contamination of the peritoneal cavity with urine. The bladder is emptied by paracentesis with a 22 gauze needle. A stab incision is made in the dorsal surface of the urinary bladder, at the least vascular area. The incision is enlarged for adequate visualization of the vesicular lumen. After removing the calculi or lesion the cystotomy incision is closed with an absorbable suture material using an inversion type of suture pattern. The abdominal wall is closed with a routine three-layer closure.

Trigone-

Incidence of cystic calculi is more in male, why?

Fundus vesicae-

Location and parts of urinary bladder-

Ligaments of urinary bladder-

- Round ligament of urinary bladder is remnant of umbilical artery.
- Urinary bladder is absent in the fowl.

Practical No. 33

Objective- To study the surgical anatomy of the cystotomy/ cystorrhaphy in cattle.

Indications- Urinary bladder calculi (cystolith), cystic tumor, for biopsy of bladder, following rupture of bladder as a sequel to obstructive calculi in the urethra, after removal of calculi from the urethra for catheterization.

Anaesthesia and control- Local infiltration anaesthesia in standing position or in dorsal recumbency.

Site- From left paralumbar fossa through a vertical incision or from paramedian prepubic incision.

Procedure- After laprotomy incision, the bladder is exteriorized and brought to the incision. Moistened laprotomy towels are placed around the urinary bladder to prevent contamination of the peritoneal cavity with urine. If not ruptured, the bladder is emptied by paracentesis with a 18 gauze needle. A stab incision is made in the dorsal surface of the urinary bladder, at the least vascular area. The incision is enlarged for adequate visualization of the vesicular lumen. After removing the calculi or lesion and clots, a polyethylene catheter with a stout sterile stilette is passed through the bladder in to the urethra. The cystotomy incision is closed with an absorbable suture material using an inversion type of suture pattern. The abdominal wall is closed with a routine three-layer closure.

- The neck is the only part of the urinary bladder not covered by the peritoneum.

Cystorrhexis-

Subtotal cystectomy-

Location and parts of urinary bladder-

Practical No. 34

Objective- To study the anatomy for ablation of mammary gland.

Indications- Gangrene of quarter or quarters, mammary tumour, suppurative mastitis etc.

Anaesthesia and Restraint- Epidural anaesthesia and/or local infiltration, in lateral recumbency.

Site - At the superiolateral aspect of the affected gland.

Procedure- After the cutaneous incision the gland is dissected away from it to expose the external pudic artery and vein located near the external inguinal ring. There flection of the cranial part of the gland exposes the perineal artery and large subcutaneous vein. All the vessels are doubly ligated. For bilateral ablation the procedure is repeated on the other side. After removal of the affected gland/glands, the skin flaps are sutured together.

Mammary glands and duct system in-

Animal	No. of glands	No. of duct system per gland
Cow		
Mare		
Ewe		
Sow		
Bitch		
Cat		

Structures involved in ablation of one half of udder, in order-

Suspensory apparatus of each half of the udder-

Arterial supply to the udder-

Venous drainage from the udder-

Nerve supply to the udder-

- **Venous ring-** The cranial mammary veins and caudal mammary veins of the two sides (left and right) anastomose at the base of the udder cranially and caudally, respectively, and forms the venous ring.
- In cow, a double sheet of median septum separate the left half and the right half of the udder completely, so one half can be removed without affecting the other. Also, the infection from one half can not reach to the other half.
- The gland with gangrenous mastitis may be made to slough off with more rapid healing by cutting the external pudendal artery and vein than it does when the circulation is intact.

Practical No. 35

Objective- To study the surgical anatomy for caesarian section in bitches.

Indications- When normal birth is impossible or when non-surgical measures have failed to resolve a dystocia.

Anaesthesia and restraint- The bitch is sedated or tranquilized and under local anaesthesia the pups are removed. Then the animal is shifted to general anaesthesia. The operation is performed in dorsal recumbency.

Site- Through a caudal midline abdominal incision.

Procedure- After abdominal incision the uterus is exteriorized and isolated with surgical towels. The uterus is incised on its dorsal midline and the pups are removed along with fetal membranes. The umbilical vessels are ligated and the uterine incision is closed in two layers of inverting sutures using absorbable suture material. The surgical towels are removed; the uterus is replaced and the abdominal incision is closed in routine manner.

Gestation period/length in:

Cow-

Buffalo-

Sheep/Goat-

Mare-

Sow-

Bitch-

Types of placenta in domestic animals:

Cow-

Buffalo-

Sheep/Goat-

Mare-

Sow-

Bitch-

Site of incision for Caesarian section in:

Cattle-

Mare-

Camel-

Foetotomy-

Structures involved in caesarian section in order-

Practical No. 36

To study the os coxae of ox, horse, dog and pig

The os coxae is the largest flat bone in the body. It consists of three parts:-

1. **Ilium**: - largest bone, triangular shape and has two surface s (gluteal surface- gluteal lines and pelvie surface-iliopecteneal line and psos tuberele), three borders (anterior, medial and lateral) and three angles (lateral, medial and acetabular)
2. **Ischium**: - forms the posterior and ventral part of pelvic cavity. It has two surfaces (pelvicandventral),fourborders(anterior,medial,lateralandposterior)andfourangles (anteromedial, anterolateral, posteromedial and posterolateral)
3. **Pubis**:-is the smallest component and forms anterior parts of floor of pelvis. It has two surfaces (pelvic, ventral), three borders (anterior border- iliopectineal eminence Tuberischii, medial border, and posterior border) and three angles (medial, acetabular and posterior)

These meet together and form the cotyloid cavity known as **Acctabulum**.

The **pelvic girdle** includes the os coxae of either side. The **bony pelvis** includes- Pelvic girdle, Sacrum and first two coccygeal vertebrae. The bony pelvis has:

A roof, a floor, lateral walls, entrance and an exit.

Obturator foramen: - formed by Pubis and ischium allows museles, blood vessels, nerves etc to pass.

Acetabulum: - Lodges head of femur articular and non-articular parts. Two notches.

Identification of Species: -

Ox:-

1. The pelvic surface consists of two parts separated by a **rounded** ridge.
2. Ventral ridge is present at the symphysis ischii.
3. The tuber ischii bears three tuberosities.
4. Ischial arch is very deep.
5. Obturator foramen is elliptical in outline.

Horse:-

1. The ilium is larger and slightly divergent forward.
2. The wings of ilia are more extensive and have gluteal lines.
3. The rounded ridge on the pelvic surface is absent.
4. The ventral ridge on the ischial symphysis is absent.
5. Tuberischii bears the two tuberosities.
6. Ischial arch wide, but not very deep.
7. Obturator foramen is large and oval.

Dog:-

1. Wing of ilium distinctly concave.
2. The lesser sciatic notch is absent
3. The acetabulum and acetabular notch are deep.

Pig:-

1. Os coxae is longer and narrower
2. Wing of ilium divided into two fossae by distinct gluteal lines.
3. The symphyseal part of the pubis is thick and two bones are in horizontal plane.

Sexual differences in pelvic girdle: -

A. Females floor of the pubis is concave
Pelvic outlet is large

B. Males: pubis is thick medially
Floor of pubis is convex.
Pelvic outlet is small

C. Diameter – Transverse diameter is larger in female

Exercise:-

Draw the diagrams of pelvic girdle of ox, horse, dog and pig (frontal view).

Practical No. 37

To study the femur of ox, horse, dog and pig.

The femur is the largest bone and forms the skeleton of the thigh. For description it consists of a shaft, and two extremities. Proximally fits in acetabulum (Hipjoint) distally meet Tibia and patella (Stifle Joint)

Shaft: - consists of four surfaces.

Surfaces: -

Anteriorsurface:- is confined to the proximal third of the shaft. Lower down a ridge separates the medial and lateral surfaces.

Posterior surface: - is a rough and bears ridge for muscular attachment.

Lateral surface : - At the distal extremity, there is a rough shallow depression known as supra condyloid fossa-arise supra digital flexor.

Medial surface: - bears trochanter minor on its proximal part. Iliopsoas muscles attaches.

Extremities: -

Proximal extremity: - consists of head, neck and trochanter major (attach gluteal muscles) The head is situated medially and has a small notch in it known as fovea capitis- to which attaches round ligament.

Distal extremity: - comprises of trochlea infront and two condyles behind. The medial and lateral condyles are separated by intercondyloid fossa. It lodges the spine of the tibia. Between the lateral condyle and ridge of the lateral trochlea, there is a rough depression. The extensor fossa (all extensors originate).

Identification of species:-

Ox: -

a. Trochanter major rises above the level of head.
b. Fovea capitis lodges only round ligament.
c. Trochanter major is single and bears a deep trochanteric fossa.
d. A trochanteric ridge joins the trochanter major with trochanter minor and forms the lateral well of the trochanteric fossa.

Horse:-

1. At the lateral border **trochanter tertius** is present at the junction of proximal and middle third.

2. The trochanter major is divided into two parts by a notch. The anterior one is known as convexity and the posterior one known as summit.
3. Supra condyloid fossa is larger and deeper.
4. The trochanteric ridge donot join the trochanter major and minor and continued straight downward.

Dog:-

1. The shaft is cylindrical and curved.
2. **Supra condyloid fossa** and **trochanter tertius** is absent.
3. Trochanter major is not extended above the head of femur.

Pig:-

1. Shaft is wide and massive.
2. There is no supra condyloid fossa.
3. The head is strongly curved is marked towards the medial side by a large fovea for the attachment of only round ligament.
4. The trochanter major is massive but not extend above the head.

Identification of side:-

1. Head is medial.
2. Trochlea is distal and anterior.

Exercise:-

1. Draw the diagrams of the femur of ox, horse, dog and pig and label different points. Set the femur in normal position in body between Acetabulum; and tibia and patella.

Practical No. 38

To study the tibia and fibula of ox, horse, dog and pig.

The tibia and fibula are long bones, which form the skeleton of leg attach above with femur (stifle Joint) and below with tarsus (hock joint). The tibia comprises of a shaft and two extremities.

Shaft is three sided and presents three surfaces and three borders.

Medial surface: - is broad above and presents rough prominence (medial ligament).

Lateral surface: - is smooth and somewhat spiral.

Posterior surface: - is flattened and bears muscular lines (deep digital flexor) and down is smooth parts (popliteus muscle).

Anterior border: - is very prominent in its proximal third forming the crest of tibia.

Medial border: - is straight and rounded in its proximal third.

Lateral border: - has nutrient foramen at the junction of proximal and middle third.

Proximal extremity: - comprises of two articular surface having a central tibial spine. Condyloid fossa on before and behind the spine. The condyles are separated behind by the popliteal notch. The lateral condyle has got laterally the proximal extremity the rudimentry fibula fused with it. Large anterior eminence is Tibial tuberosity (patellar ligament).

Distal extremity: - is quadrilateral in form and presents an articular surface. It consist of two grooves separated by a ridge and guarded by malleoli (collateral ligament of hock joint)

Identification of species:-

Ox: -

1. The proximal extremity has a large anterior eminence known as tibial tuberosity.
2. The ridges and grooves in the distal extremity are straight indirection.
3. The posterior surface has linea muscularis and in the proximal fourth of the posterior surface is a narrow triangular area for the insertion of popliteal muscles.
4. The **lateral malleolus** articulates separately.

Horse: -

1. The posterior surface is divided into two parts by a rough popliteal line which runs obliquely form the proximal part of the lateral border to the middle of the medial border.
2. The tibial tuberosity is marked infront by groove.
3. The grooves and ridges of the distal extremity are directed obliquely.
4. Fibula reduced to a head and shaft only. **Lateral malleolus** is fused.

Dog: -

1. The tibia and fibla both are well developed bones and almost same in length.
2. The tibial crest is short and prominent and marked with impression.

Pig:-

1. Tibial crest is long and distinct.

Identification of side: -

Tibial crest is anterior.

Fibula: - Reduced long bone, no shaft, only extremities.

Proximal extremity: - head fuse with lateral condyle of tibia.

Distal extremity: - reaches upto lateral malleolus in ox.

Fuses with tibia- fused (rudimentary) lateral malleolus in horse.

Exercise:-

1. Draw the diagrams of the tibia and fibula of ox, horse, dog and pig and label different points.
2. Set the tibia and fibula in normal position in body between femur and carpals.

Practical No. 39

To study the Patella of ox, horse, dog and pig.

It is the largest sesamoid bone, which develops in the tendon of quadriceps femoris muscle and articulates with the trochlea of the femur. It presents.

Two surface: - anterior and articular.

Two borders: - Lateral and medial.

Base: - Proximal

Apex: - Distal

Ox: -

It is relatively larger, but the base is smaller and apex is pointed

Horse: -

Patella is short but wide from side to side.

The base is larger than that of ox and apex is blunt pointed.

Dog:-

The patella is long and narrow.

Pig:-

The patella is very much compressed transversally and presents three surfaces.

Exercise:-

1. Draw the diagram of patella of ox, horse, dog and pig.

Practical No. 40

To study the bones of pes of ox, horse, dog and pig.

The skeleton of pes consists of: -

Tarsus

Metatarsus

Digits

Tarsus: - The tarsus consists of the following bones:-

Tibial tarsal (T), Fibular tarsal (F), Cental tarsal (C), 1st , 2nd .3rd, and 4th tarsal.

Ox: - There are 5 bones

T	F	C
1	2+3	4

Horse: - There are 6 bones

	T		F
	C		
	1+2	3	4

Dog: -There are seven bones.

T		F	
C			
1	2	3	4

Pig: - There are seven bones and the formula is same as in dog.

T		F	
C			
1	2	3	4

Metatarsus and digits : - The metatarsals and digits are similar to the equivalent bones in the forelimb except in ox, the vestigial metatarsal remaining is the 2nd metatarsal.

Exercise:-

1. Draw the diagram of bones of pes of ox, horse, dog and pig.

Practical No. 41

Sacral Vertebrae/Sacrum: -

These are fused and form a single mass – sacrum.

It consists of two surface, two borders, a base and an apex.

Identification of Species

Ox:-

1. The sacrum is formed by the fusion of five sacral vertebrae.
2. It is triangular inform
3. The Dorsal spinous processes of all the vertebrae are fused and thus it forms a **median sacral crest**.
4. On either side of the median sacral crest, there is groove bounded laterally by the **lateral sacral crest**.
5. There are four dorsal and four large oval ventral sacral foramina.
6. The pelvic surface is concave.
7. In the middle it is marked by central groove which indicate the site of middle sacral artery.
8. Four transverse lines are visible on the pelvic surface indicating the demarcation of the bodies of the individual sacral vertebra
9. The wings are quadrangular.

Horse:-

1. Dorsal spionous processes are not fused.
2. The lateral sacral crest is suppressed.
3. Ventral sacral foramina are smaller.
4. Wings are prismatic and pointed at their end.

Dog:-

1. Sacrum comprises of only three sacral vertebrae.
2. Median sacral crest is notched.
3. Lateral sacral crest is represented by two tubercles.
4. The two dorsal and two ventral sacral foramina are present.
5. Wings are high and articular surfaces are directed outward and placed close to the lateral border.

Pig:-

1. It consists of four vertebrae, which fuse less completely than other animals.
2. Spines are little developed and commonly in part absent.
3. On dorsal surface, on either side, are three dorsal sacral foramina.
4. Ventral surface is less strongly curved and the transverse lines are very distinct.

Exercise:-

1. Draw the diagram of sacral mass of ox, horse, dog and pig. (Dorsal and ventral view).

Practical No. 42

Articulation of the Hind limb

1. **Sacro iliac articulation: -**

   Joint: -

   Amphiarthrosis.

   Movement: - Restricted in young and not appreciable in adult.

   Bones involved: - Articular surface of the wings of sacrum and articular surface of ilium.

   (2) Accessory ligament.

   (a) Dorsal sacro- iliac ligament.

   (b) Lateral sacro- iliac ligament.

   (c) sacro-sciatic ligament.

   (d) Ilio lumbar ligament.

2. **Hip joint:-**

   Joint: - Ball and socket.

   Movement: -Polyaxial.

   Bones involved: - Cotyloid cavity of os coxae and head of femur.

   Ligaments: - (1) Capsular ligament.

   (2) Round ligament.

   (3) Cotyloid ligament.

   (4) Accessory ligament of femur (check ligament).

3. **Stifle joint: -** It is complex joint comprises of two articulations.

   (A) Femoro-patellar articulation.

   (B) Femoro tibial articulation.

(A) Femoro-patellar articulation: -

(2) Lateral ligament.

(3) Medial ligament.

(4) Patellar straight ligaments – Medial, Middle and Lateral.

4. Femoro tibial articulation: -

Joint: -Ginglymus.

Movement: - Extension, flexion and a limited rotatory movement.

Bones involved: - Condyles of femur and proximal end of tibia. The **menisci** are placed between the articular surfaces.

Ligaments: - (1) Capsular ligament.

(2) Medial ligament.

(3) Lateral ligament.

(4) Cruciate ligament.

(b)

5. Hock joint: - It is acompound joint. It consists of (a) Tibiotarsal articulation, Intertarsal articulation, (c) Tarso metarsal articulation.

Joint: - Tibio-tarsal articulation - Ginglymus. Other articulations – Gliding.

Movement: - Tibio-tarsal articulation-Extension and flexion and other articulation. Gliding movement.

Bones involved: - Distal end of tibia, tarsal bones, lateral malleolus and proximal end of metatarsal.

Ligaments: - (1) Capsular ligament.

(2) Medial ligament.

(3) Lateral ligament.

(4) Anterior oblique and posterior oblique ligament.

Exercise:-

1. Draw the diagram of joint of Hind limb.

Practical No. 43

To study the blood supply of Hind limb

The **external iliac artery** arises from the abdominal aorta ventral to the body of the 6th lumbar vertebra. It is located in the medial aspect of hip region along the cranial border of shaft of ilium near the vertebral column which gives the blood supply to hind limb in the medial aspect of thigh region it is continued as **femoral artery** accompanying the saphenous nerve inside the femoral canal. Branches of **external iliac artery** are-

Sl.No.	**Arteries**	**Structures supplied**
1	Deep circumflex iliac artery-	
2	Deep femoral artery-	
(a)	Pudendo epigastric trunk-	
(i)	Caudal epigastric artery-	
(ii)	External pudendal artery-	
(b)	Medialcircumflex female artery	
3	Femoral artery	

Femoralartery: The femoral artery is the distal continuation of the external iliac artery. It descends in the femoral canal along with saphenous nerve and femoral vein. It continues further to popliteal region, where it courses between the two heads of the gastrocnemius muscle as the **popliteal artery**. The chief branches of **femoral artery** are-

Sl.No.	**Arteries**	**Structures supplied**
1	Lateralcircumflex femoral artery-	
2	Saphenous artery-	
(a)	Medial planter artery-	
(b)	Lateral planter artery-	
3	Descending genicular artery-	
4	Caudal femoral artery-	
5	Popliteal artery-	
(a)	Cranial tibial artery-	
(b)	Caudal tibial artery-	

Digital circulation in hind limb

Dorsal view: Cranial tibial artery supplies the dorsal aspect of the digits of hindlimb. This artery is the direct continuation of the popliteal artery. As it descends on the dorsal aspect of the tarsus, it is called the **dorsal pedal artery**. This dorsal pedal artery gives off the proximal perforating branch at the level of the inter-tarsal articulation which joins in the proximal (deep) planter arch. After that it is continued downwards as the **dorsal metatarsal artery III**. It gives off the distal perforating branch which is connected with the distal (deep) planter arch. After that the dorsal metatarsal artery III becomes continued as the dorsal common (pedal) digital artery III which supply the 3^{rd} and 4^{t} h digits as the **dorsal proper**

(pedal) digital artery III and IV, respectively.

Planter view: The **saphenous artery** supplies the planter aspect of the digits of hindlimb. At the level of tarsus it is divided into medial and lateral planter arteries.

(a) Medial planter: It descends downwards along the planter medial aspect of the tarsus. It gives off a deep branch which takes part in the formation of the proximal (deep)planter

arch on the proximal part of the planter surface of the metatarsus. From this arch **planter metatarsal arteries II and III** arise and invariably forms the distal (deep) planter arch. Now, near the distal 2/3rd of the metatarsal region, the medial planter artery is divided into **planter common digital arteries II and III**. The planter common digital artery II descends to the 3rddigit as the **planter proper (abaxial) digital arteryIII**. The planter common digital artery III at the level of first phalanx divides into **planter proper (axial) digital artery III and IV** which supplies to the respective digits.

(b) Lateralplanter: Within the proximal 3rdof the metatarsus, it gives off a deep branch which helps in the formation of the proximal (deep) planter arch. Then it courses distally and takes part in the formation of distal (deep) planter arch. After that the main artery is called **planter common digital artery IV** in the metatarsal region. Then it continued distally as the **planter proper digital artery IV** at the level of first phalanx which supplies the fourth digit.

EXERCISE:

1. Draw a well labelled diagram of the branches of external iliac artery of ox.

Practical No. 44

Location of lymph nodes of Hind limb:

1. **Prefemoral L.N.:** It is situated in front of tensor fascia latae.
2. **Popliteal L.N.:** It lies in fat on gastrocnemius between biceps femoris and semitendinosus and seminembranosus.
3. **Coxal L.N.:** It lies in front of rectus femoris

Practical No. 45

To study the Nerves supplying Hind limb

Lumbosacral plexus: It is formed by the ventral branches of the **4th, 5th** and **6th lumbar** spinal nerves and those of **1st** and **2nd sacral** spinal nerves. This plexus comprises of an (A) anterior (lumbar) and a (B) postersior (sacral) parts. The anterior part lies on the ventro-lateralaspectofthelumbartransverseprocessesofthe5th and 6thlumbar vertebrae and the posterior part lies on the antero- lateral aspect of the wings of sacrum.

(A) The Anterior part (Lumbar plexus): It gives the following nerves:

(1) Lateral cutaneous femoral nerve: It passes downwards towards the cranial aspect of the tuber coxae and it innervates the psoas major, psoas minor and iliacus muscle.

(2) Greatcrural/femoral nerve: It derives its fibers from the fourth and fifth lumbar nerves. It is the largest of the three branches. It gives off internal saphenous nerve and gives number of branches, which supplies to four heads of the quadriceps femoris and the articularis genu.

An another branch arise from great crural nerve, a little above the brim of pelvis termed as internal nerve. It gives off branches to iliacus, Sartorius and femoral artery. It passes downward and gives off several cutaneous branches down to the hock.

(3) Obturator nerve: It forms the continuation of the ventral branch of the fifth lumbar nerve together with the femoral. It proceeds to the obturator foramen and supplies the obturator intermus, passes out of the pelvic cavity through the anterior part of the obturator foramen and supplies the muscles of the medial aspect of the thigh.

(B) The Posterior part (Sacral plexus):

(1) Cranial/Anterior gluteal nerve: It derives its fibers chiefly from the ventral branches of the sixth lumbar and first sacral nerves. It emerges out through the greater ischiatic foramen and innervates the middle and deep gluteal muscles.

(2) Caudal/Posterior gluteal nerve: It derives its fibers essentially from the ventral branches of the first and second sacral nerves. It runs caudally and divides into a dorsal

and ventral branch. The dorsal branch furnishes the gluteus medius muscle, whereas the ventral branch courses toward the ischiatic tuber and supplies the gluteobiceps muscle.

(3) Ischiatic nerve: It is the largest nerve of the body. It derives its fibers from sixth lumbar and first and second sacral nerves. It leaves the pelvic cavity through the greater sciatic foramen and continues inside the two heads of gastrocnemius muscle as **internal popliteal nerve.**

Branches of ischiatic nerve:

(a) The nerve to obturator internusmuscle

(b) The nerve to gamellus and quadrates femoris muscles

(c) Large muscular branch to biceps femoris, semitendinosus and semimembranosus muscles.

(d) **External saphenous nerve:** It descends over the lateral head of the gastrocnemius and under the cover of biceps femoris. It passes downward to the lower third of the leg and divides into number of branches which are distributed to the skin of the tarsal and metatarsal regions.

(e) **Fibular/Common peroneal/External popliteal nerve:** It is detached from the sciatic nerve at about the level of lesser sciatic foramen. It descends downward and diverges outward and forward across the external face of the lateral head of gastrocnemius. The n, it divides into superficial and deep branches. Its collateral branchesare:

(i) Muscular branch to biceps femoris

(ii) Cutaneous branch to skin on outer aspect of stifle

(iii) Muscular branch to lateral head of the gastrocnemius.

The terminal branches of the fibular nerve **superficial** and **deep fibular** nerves.

Superficial fibular nerve: It is the stronger of the two branches. It descends down and at the dorsal surface of the tarsus gives off **dorsal common (pedal) digital nerve IV**. It gives branches to lateral accessory digit and continues as the **dorsal proper (abaxial)**

Digital (pedal) nerve IV: Near the middle of the metatarsus the fibular nerve releases the **dorsal common (pedal) digital nerve II** and continues further as the **dorsal common (pedal) digital nerve III**. The dorsal common (pedal) digital nerve II, near the fetlock joint, gives branches to the medial accessory digit and descends as the **dorsal (apaxial) proper (pedal) digital nerve III**. At the level of the fetlock joint the dorsal common

(pedal) digital nerve III communicates with the dorsal metatarsal nerve III and divides into two **dorsal (axial) proper (pedal) digital nerves III and IV**. This superficial fibular nerve also gives muscular branches to the lateral digital extensor muscle.

Deep fibular nerve: It dips between the lateral digital extensor and fibularis longus and gives branches to them. In the metatarsal region it continues as the **dorsal metatarsal nerve III** which, near the fetlock joint, unites with the **dorsal common (pedal) digital nerve III**. It gives off communicating braches, which, after traversing the interdigital space join the corresponding planter proper (axial) digital nerves.

Internal popliteal nerve: It is the continuation of sciatic nerve. It dips in between the two heads of the gastrocnemius and continue at the inferior border of the popliteal muscle as **tibial nerve**. It gives off muscular branches to outer and inner heads of gastrocnemius, popliteus, superficial and deep digital flexors and soleus muscles.

Tibial nerve: It is the continuation of internal popliteal nerve. It emerges beneath the medialheadofgastrocnemiusanddescendsontheinnersideoftheleginfrontofthetendo- achilis. At the level of hock, it divides into medial and lateral planter nerves.

The medial planter nerve divides into the **planter common digital nerve II** and **III** above the fetlock joint. The planter common digital nerve II gives off branches to medial accessory digit and descends as the **planter proper (abaxial) digital nerve III**. The planter common digital nerve III divides into two **planter proper (axial) digital nerves III and IV** in the inter-digital space.

The lateral planter nerve on the planter aspect of the proximal extremity of the metatarsus gives off deep branch to the interosseous muscle and continues as the planter common digital nerve IV. Near the fetlock joint, it gives branches to the lateral accessory digit and extends as the **planter proper (abaxial) digital nerve IV**.

EXERCISE

Origin of lumbosacral plexus in different species:

(a) Horse:

(b) Dog:

(c) Sheep and goat:

(d) Pig:

(e) Rabbit:

(f) Fowl:

EXERCISE :

1. Draw a well labelled diagram of Lumbo sacral plexus of ox.

Practical No. 46

Objective- To study the surgical anatomy of urethrotomy.

Indication- Obstructive urolithiasis.

Anaesthesia and Restraint-

Cattle- Local anaesthesia in lateral recumbency.

Dog- Under general anaesthesia in dorsal recumbency.

Site- Cattle: Two approaches-

A. Post-scrotal urethrotomy- Through a 10 to 15 cm long midline incision extending from the scrotum.

B. Ischial urethrotomy- Through a mid line incision in the ischial region.

Dog- Through a midline incision between the os penis and the scrotum.

Procedure-

Cattle - After skin incision the penis is exteriorized and the sigmoid flexor is straightened (approach A). The urethra is palpated at the ventral surface of the penis for presence of a stone. A small incision is made directly over the calculus (calculi) and the stones and concretions are removed. Prior to closure of the urethra, a catheter should be inserted up the urethra, both proximally and distally, to search for further stones and ensure urethral potency. The urethra is then sutured using simple continuous or simple interrupted sutures with an absorbable suture material. The penis is replaced into its normal position. The muscles and fascia are sutured and skin is sutured in routine manner.

Dog- A midline incision is made over the urethra and between the os penis and the scrotum. The urethra is incised on the ventral midline directly over the calculus (calculi).The urethral calculi are flushed through the urethrotomy. Following calculi removal, the catheter should be passed in to the urinary bladder. The urethrotomy incision may be left open to heal by granulation or it may be sutured as in cattle.

Urethrostomy- Site of urethral calculi in

Cattle-

Dog-

Boar-

Ram-

Buck-

Camel-

Why urethral obstruction is more common in :

Male than female-

Castrated male than intact male-

Structures involved in urethrotomy in order-

Practical No. 47

Objective- To study the surgical anatomy for castration.

Indications- For immediate emasculation for quick and economic fattening of beef cattle, prevention of indiscriminate breeding etc.

Anaesthesia and Control- Epidural anaesthesia in lateral recumbency or standing position (No anaesthesia is needed in castration by closed method).

Special instrument- Emasculator (in camel and horse)

Procedure-

Closed Method- In this method the castration is done by crushing the spermatic cord with the help of a Burdizzo's castrator.

Open Method- A 12 to 15 cm long vertical incision is given over the median scrotal raphe. After separating the dartos and fascia by blunt dissection, the testicle is freed of scrotal fascia and exteriorized along with the spermatic cord. The contents of the cord are then separated and doubly ligated and severed in between ligatures. The scrotal wound can either be sutured routinely or left open for drainage and spontaneous healing.

Position of testes in

Bull-

Horse-

Dog-

Buck-

Camel-

Ram-

Boundaries of inguinal canal-

Structures involved in castration in order-

Contents of spermatic cord-

Vasectomy-

Scrotal sac ablation-

Caponing in fowl-

Practical No. 48

Objective- To study the surgical anatomy of the amputation of penis in cattle.

Indications- Following urethral rupture, following necrosis of preputial part of the penis as a result of prolonged paraphimosis.

Anaesthesia- Epidural anaesthesia with or without local anaesthesia in lateral recumbency.

Site- By post-scrotal approach **t**hrough a 10 to 15 cm long midline incision extending from the scrotum.

Procedure- The penis is pulled out through the incision, the prepuce may be incised after applying traction to the penis. The retractor penis muscle is then severed as proximally as possible. The penis is transected after ligating the dorsal vessels. The penile stump is sutured to the skin. The skin up to the close proximity of the stump is sutured.

Parts of penis-

Types of penis-

Structures observed in cross section of penis-

Blood supply to the Penis-

Nerve supply to penis-

Errectile tissue of penis :

i. **Corpusspongiosum-**
ii. **Corpuscavernosum-**

Define :

i. **Sigmoid flexor-**
ii. **Os penis-**
iii. **Corona glandis-**
iv. **Urethral process-**
v. **Ampulla-**

Practical No. 49

Objective- To study the surgical anatomy of the ovariohysterectomy in bitches.

Indications- For sterilization and for treatment of pyometra, neoplasia of the genital tract, or hyperplasia and neoplasia of the mammary glands.

Anaesthesia and Restraint- Under general anaesthesia in dorsal recumbency (mid ventral approach) or lateral recumbency (Flank approach).

Site - a) Mid- ventral abdominal incision through linea alba (conventional method).

b) Through a right flank approach (mini- laprotomy/ key hole surgery).

Procedure- After abdominal incision the uterine horn is extracted from the abdomen using an ovariohysterectomy hook. The ovary is grasped by the hand and two forceps are clamped on the ovarian pedicle proximal to the ovary, a third forceps are clamped at the uterine end. Now a ligature is applied on the ovarian stump, at the site of lower forcepsafterremovingitandthepedicleisthencutfromabovethesecondforceps.The second ovary is removed in a similar manner. After this the uterine artery running on the either side of the body of the uterus are ligated and three forceps are applied on the uterine body and a ligature is applied. The uterus is severed from above the ligature and removed. The abdominal incision is closed in a routine manner.

Differential features of ovary in :

	Cow	**Mare**	**Sow**	**Bitch**
Shape-				
Surface-				
Bursa-				
Ovulation-				

Differential features of uterus in :

	Cow	**Mare**	**Sow**	**Bitch**
Horns-				
Body-				
Cervix-				

Pre-cervical ovariohysterectomy-

Post-cervical ovariohysterectomy-

Oopherectomy-

Spaying-

Practical No. 50

Objective- To study the surgical anatomy of mediopatellar desmotomy.

Indications - Upward fixation of the patella.

Anaesthesia and Restraint- In lateral recumbency with or without local anaesthetic infiltration.

Site- Internal aspect of the stifle joint, close to the anterior tibial tuberosity.

Procedure - The animal is restrained with the affected limb lowermost and the other three limbs are tied together. The affected limb is drawn slightly backward in such a way that the stifle joint is flexed completely. In this position the limb is tied or held tightly, which makes the medial patellar ligament cut. The site is identified as a groove or depression between anterior and medial ligaments, at about 2-3 inch anterior and 2- 3 inch medial to the anterior tibial tuberosity. A stab incision is given at this site and then the medial ligament is severed. The wound is left unsutured.

Structures involved in me diopatellar desmotomy, in order-

Blood supply to the stifle joint-

Practical No. 51

Objective- To study the surgical anatomy of amputation of the digit.

Indications - Irreparable injury, fracture or necrosis and destruction of the distal phalanx and adjacent tendons and ligaments.

Anaesthesia and Restraint- Under ring block, digital nerve block or intravenous regional anaesthesia, in standing position or in lateral recumbency with the affected claw uppermost.

Site- At the coffin joint, at the pastern joint, the middle of the middle phalanx or at the level of distal third of the proximal phalanx.

Procedure- The affected foot is thoroughly cleansed and prepared for aseptic surgery. A rubber tourniquet is applied above the fetlock. The skin incision is made along the abaxial and axial surfaces of the affected c law just above the coronet. The vertical incisions are then made through the length of the interdigital skin to extend about three centimeters up the dorsal and palmer or plantar sides of the foot. The skin and underlying tissues are incised through until bone is exposed. The skin flap is retracted and the digit is then amputed with the help of a wire saw.After removal of the resected claw, all the devitalized and necrotic tissues are excised. The tourniquet is removed and the vessels are ligated or cauterized. The skin flap is then sutured over the stump.

No. of digits and sesamoids in

Cattle-

Horse-

Dog-

Intravenous regional anaesthesia-

Structures involved lateral digit amputation, in order-

Structures involved medial digit amputation, in order-

Volar digital nerve block (High and Low)-

Plantar digital nerve block

Practical No. 52

Objective - To study the anatomy for the amputation of limb.

Indications - Irreparable injury, gangrene and tumor.

Anaesthesia and Restraint- General anaesthesia or sedation with intravenous regional anaesthesia in lateral recumbency.

Site - The limb is amputed from a healthy part just proximal to the diseased or injured part.

Procedure - A tight tourniquet is applied below the elbow or the stifle as the case may be. Skin flaps are made by two incision on the dorsal and ventral aspects at the site. The lateral flap is kept longer than the medial so that after suturing the suture line remains on the medial aspect of the stump and does not come in contact with the ground. After skin the muscles are also incised to form the muscular flaps. The bone is sawed off using wire saw or Hexa saw. The vessels are ligated and nerve ends are crushed. The bone stump is closed by suturing muscular stump and then the skin flap is closed.

Extensors of the fore limb-

Flexors of the fore limb-

Extensors of the hind limb-

Flexors of the hind limb-

- In large animals the amputation of a limb is done only when the animal is able to get up and bears weight on remaining three limbs.
- Dogs can always bear weight on three limbs.