

REGIONAL SURGERY & LARGE ANIMAL SURGERY

LECTURES DELIVERED BY:

Dr. M. Arif Zafar

Department of Clinical Medicine and Surgery
Faculty of Veterinary & Animal Sciences
PMAS Arid Agriculture University Rawalpindi

COMPILED & PRESENTED BY:

Waqas Nawaz



Pir Mehr Ali Shah
ARID AGRICULTURE
University Rawalpindi

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Q#1: Why Vomiting is absent in cattle?

Ans: Chemo-Receptor Trigger Zone (CRTZ) is present in the medullary region of brain which initiates the anti-peristaltic movements. This is absent in ruminants.

Q#2: Why is fasting done before surgery even when ruminants do not vomiting?

Ans: If we don't do fasting, the lungs or respiratory system will collapse due to pressure of rumen. So 36 hour of fasting & 24 hour without water is recommended in ruminants.

Regional Nerve Blocking or Regional Analgesia

In advance veterinary surgery, every surgeon avoids giving general anesthesia because it is more **risky** so a particular area or quarter is selected & blocked. Rest of the body can be kept or standby or no sedation. In large animals regional nerve blocking is preferred over general anesthesia because it is;

- ✓ Relatively simple technique
- ✓ General availability & inexpensiveness
- ✓ Minimal apparatus i.e needle, syringe, & drugs
- ✓ Little risk of toxic side effects
- ✓ Safety

Ophthalmic Region:

- i. Auriculo-Palpebral Nerve Blocking
- ii. Optic Nerve Blocking
- iii. Retrobulbar Nerve Blocking
- iv. Transpalpebral Nerve Blocking

Cervical Region: (C₆-C₇)**Cranial Region:**

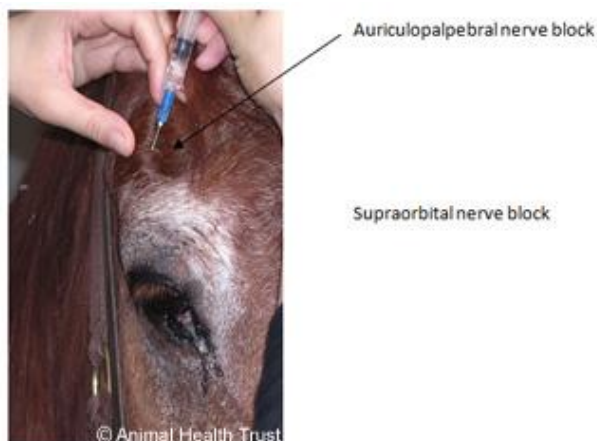
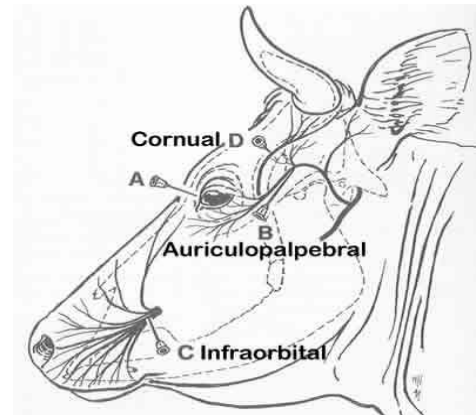
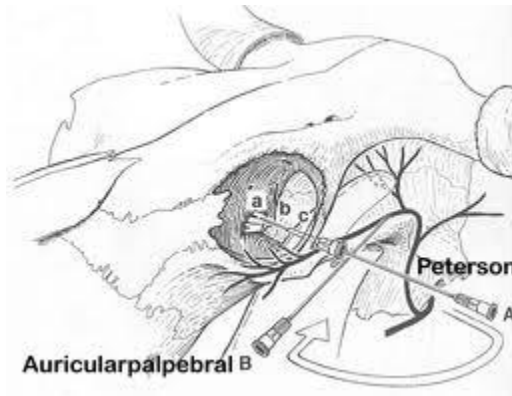
- i. Auriculo-Palpebral Nerve Blocking
- ii. Optic Nerve Blocking
- iii. Retrobulbar Nerve Blocking
- iv. Transpalpebral Nerve Blocking
- v. Cornual Nerve Blocking
- vi. Mandibular Nerve Blocking

Abdominal Region/Perineal Region:

- i. Dorsal Paravertebral Nerve Blocking
- ii. Distal Paravertebral Nerve Blocking
- iii. Dorsolumbar Epidural Nerve Blocking
- iv. Cranial Epidural Nerve Blocking
- v. Caudal Epidural Nerve Blocking
- vi. Segmental Epidural Nerve Blocking
- vii. Modified thoraco-lumbar Nerve blocking

1- AuriculoPalpebral Nerve Blocking:

- ♣ Auriculopalpebral nerve is actually a branch of Trigeminal nerve
- ♣ It can be approached from Zygomatic arch.
- ♣ Locate zygomatic arch
- ♣ Insert needle



2- Optic Nerve Blocking:

- ♣ Hold the eye ball & get idea about its depth
- ♣ Approach through medial & lateral canthus of eye to optic nerve
- ♣ 20G spinal needle
- ♣ Medial canthus approach is easier

3- Retrobulbar Nerve Blocking:

Technique

- produce topical analgesia of cornea with butyn sulphate or proparacaine
- insert forefinger into lateral canthus between eyeball and conjunctival sac
- alongside finger pass 1.25 metric 7.5–10 cm curved needle through fornix of conjunctiva until point is retrobulbar (see Figure 1.5)
- ensure that needle point does not enter optic foramen (risk of intrathecal {CSF} injection), and attempt aspiration check

- inject 20–30 ml 2% lignocaine solution, which blocks nerves to ocular muscles causing paralysis of the eyeball and analgesia
- do not attempt to anaesthetise optic nerve, since this may stimulate animal sufficiently to cause fatality
- anaesthetise upper and lower lids by local infiltration as required

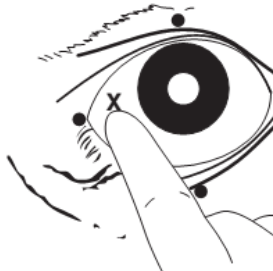


Figure 1.5 Retrobulbar block. Two methods are shown:

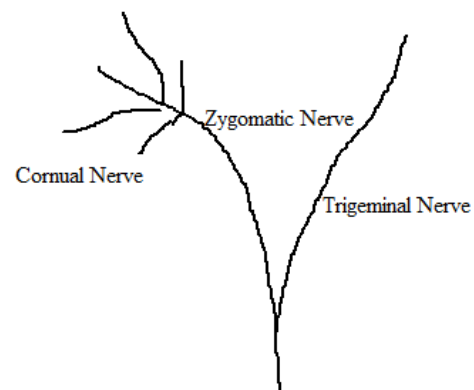
(a) needle insertion at four points (black circles) through conjunctiva under careful digital guidance (4×8 –10 ml);

(b) needle insertion at lateral or medial (X) canthus, again perforating conjunctiva to deposit solution at orbital apex (20–30 ml).

Use 18 gauge needle 15 cm long with marked curvature, advancing tip slowly.

4- Transpalpebral Nerve Blocking:

- ✓ It has 4 branches;
 - Two optic nerves towards medial canthus
 - Two optic nerves towards lateral canthus
- ✓ Block the nerve according to our need i.e auriculopalpebral, zygomatic etc.



5- Cornual Nerve Blocking:

- ✓ Dehorning or disbudding (Cornual nerve is actually a branch of Trigeminal nerve)
- ✓ S/C
- ✓ Fan shaped to cover more area with single pierce of needle
- ✓ Between base of horn & lateral canthus of eye (1)

6- Mandibular Nerve Blocking:

- ✓ Inject the anesthesia by inserting the needle in Mandibular foramen but avoid damage to nerves by the needle.

7- Cervical anesthesia technique:

- ✓ Approach from lateral side
- ✓ C6-C7
- ✓ Deep & protected by *Ligamentum nuchae*

8- Proximal Paravertebral Nerve Blocking (Fig, 6-1):

- ✓ Parallel to lumbar vertebra
- ✓ It is specific & difficult
- ✓ Bovine= T₁₃, L₁ & L₂
- ✓ Equines= T₁₇, L₁ & L₂

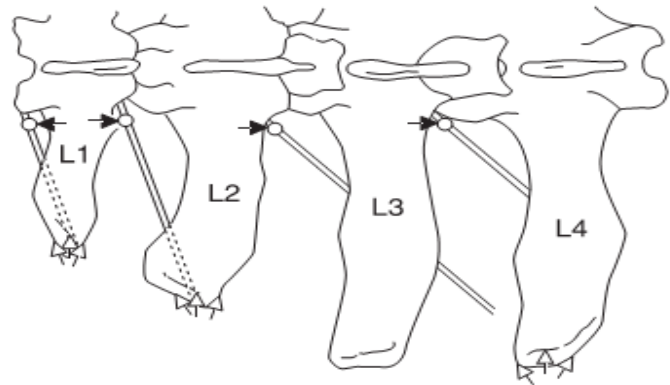
Indications:

Laparotomy, Omentopexy, Rumenotomy,

Caesarian section (Flank incision) L_{1,2,3}

Nerves:

- Illeo-hepatic nerve
- Illeo-inguinal nerve
- External spermatic nerve/Genito-femoral nerve
- Lateral cutaneous femoral nerve



Approach: 2cm away from the dorsal midline. We have to locate the cranial border of transverse process of L₁ after T₁₃ or T₁₇. And then apply the trocar with needle of 16G or 18G. After that insert 21G spine needle with slow insertion speed and when we feel rupturing or piercing while crossing the ligamentum flavum. At this point insert local anesthesia i.e Lidocaine or Lignocaine etc.

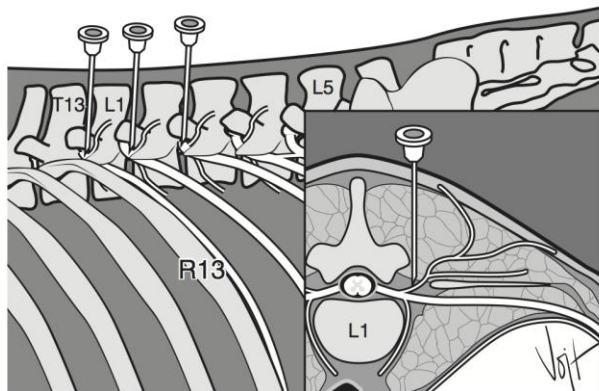


Figure 6-1 Proximal paravertebral nerve block. Note that the needles are placed just cranially to the transverse processes and less than 2.5cm from midline.

(From Muir WW, Hubbell JAE, Skarda RT, Bednarski R: *Handbook of veterinary anesthesia*, ed 3, St Louis, 2000, Mosby.)

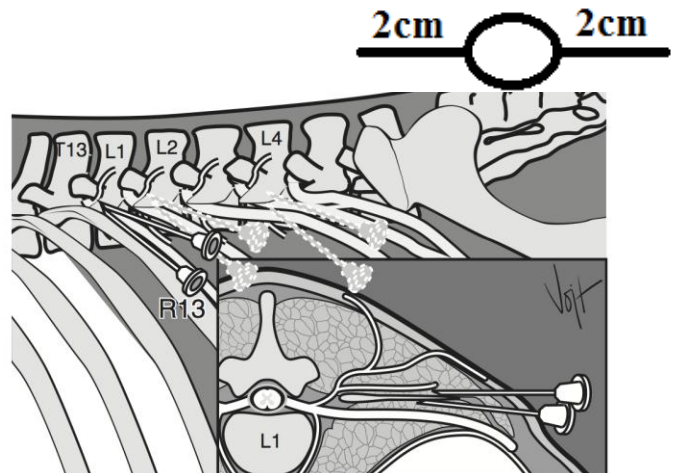
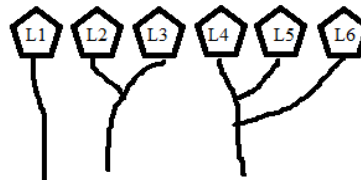


Figure 6-2 Distal paravertebral nerve block. Note that the needles are placed just above and below each transverse process, and lidocaine is infiltrated in a fan pattern.

(From Muir WW, Hubbell JAE, Skarda RT, Bednarski R: *Handbook of veterinary anesthesia*, ed 3, St Louis, 2000, Mosby.)

9- Distal Paravertebral Nerve Blocking (Fig, 6-2):

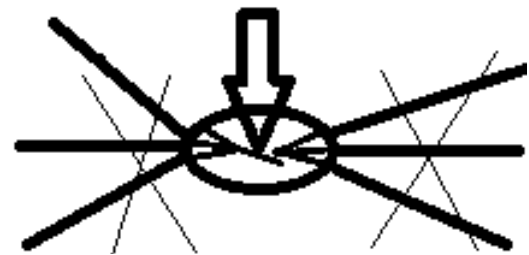
- ✓ Distal to the transverse process
- ✓ L₁, L₂ & L₄ (L₃ is missed along with L₅ & L₆ because their nerves are attached.)



Indications: Laparotomy, Omentopexy, Rumenotomy, Caesarian section (Flank incision) L_{1,2,3}, Ruptured bladder in calves

10- Intravertebral Nerve Blocking:

Its approach is very easy. It blocks both sides of nerves on left & right side of dorsal midline.

**11- Dorsolumbar Epidural Nerve Blocking:**

Indications: Especially for C-Section

Approach:

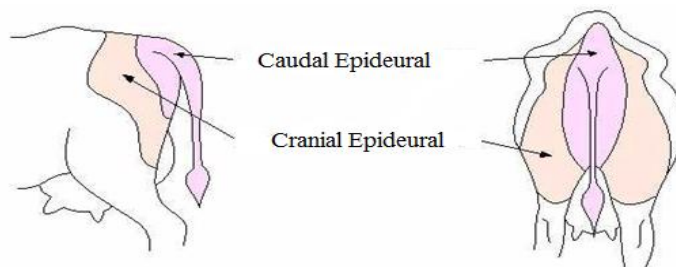
- i. Go from caudal border of last rib between T₁₂ & T₁₃
- ii. From lumbosacral fossa

Insert anesthesia in the intervertebral space of T₁₃ & L₁ (preferable) or L₁ & L₂. It is a good method for C-section.

Anesthesia: Combination of Lignocaine & Xylocaine or Ketamine for 120-160 min. Lignocaine (3-4ml) & Xylocaine (1ml) in combination because if only Lignocaine is used here a large volume (50-100ml) will be required to induce which is expensive & difficult to induce.

12- Cranial Epidural Nerve Blocking/Lumbosacral anesthesia:

- ✓ L₆ – S₁
- ✓ In lumbosacral fossa
- ✓ Location is easy to approach because here is depression which can be felt easily. In lumbosacral fossa between Oscoxae & Dorsocranial border of Ilium.



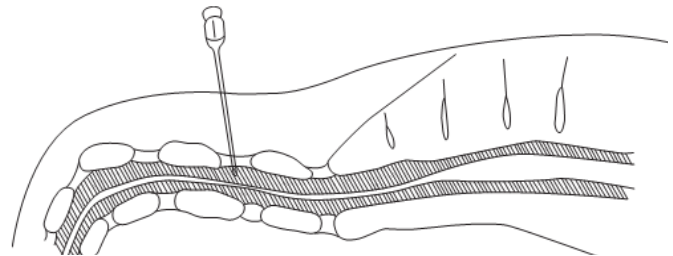
Indications: Flank Laparotomy, Surgery of hindlimb & digits, inguinal surgery, Udder & teat surgery,

Anesthesia: General & local anesthetic agents are used in combination because 50-100ml of only local anesthetic needs longer time.

13- Caudal Epidural Nerve Blocking:

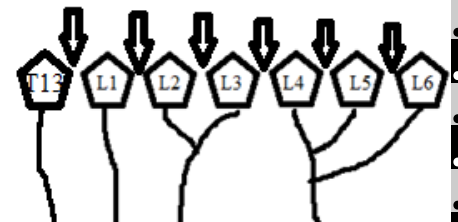
Indications: Embryotomy, Intravaginal & intrauterine manipulations, dystokia, rectal prolapse etc.

- ✓ Bovines
 - Intervertebral space of S₅ & Cox₁
 - Cox₁ & Cox₂ (With older age ossification of S₅ & Cox₁ occurs)
- ✓ Equines = Intervertebral space of S₅ & Cox₁
- ✓ Location is difficult
- ✓ 20G needle of 2cm, 20ml with green tip
- ✓ 4-5ml of local anesthetic agent
- ✓ 5-10 mint
- ✓ Tail docking



14- Segmental Epidural Nerve Blocking:

- ✓ Intravertebral or Paravertebral
- ✓ Small amount on many places rather large amount at one place
- ✓ T₁₃ to L₆



Hanging Drop Method:

It is a method to confirm that the insertion of the needle is either correct or wrong.

Procedure: inject 1-2 drops of distil water after inserting the needle at the required position. If the water comes back, it means needle is not correctly inserted.

15- Modified thoraco-lumbar anesthesia:

- ✓ Introduced by *Koreans* in 2008-2009
- ✓ Bovines = T₁₃-L₁ Equines = T₁₇-L₁
- ✓ In Intravertebral space, Local anesthesia is injected
- ✓ According to those *Koreans* , even a **C-Section** can be performed

Lignocaine & Lidocaine:

- ♣ 2% & 4% with or without Adrenaline are used
- ♣ Injection are 2% while gels or drops for topical use are 4% because after absorption only 2% reaches the target site
- ♣ Adrenaline is used when locally infiltrated. It causes vasoconstriction
- ♣ Some major veins absorb lignocaine and take it to heart which may cause sedation or slow pumping of heart leading to heart failure. So lignocaine is administered along with adrenaline to prevent Bradycardia & heart failure. This is the reason of lignocaine not administered I/V.
- ♣ If we want to do C-Section & we have to do it cranial lumbosacral anesthesia, a large amount will be required.
- ♣ 10-20ml lignocaine at one side so total would be 30-60ml because of 3 sites of abdomen
- ♣ **Combinations:**
 - Lignocaine (8ml) + Ketamine (2ml) on one side → C-Section
 - Lignocaine (4ml) + Xylazine (1ml) on one side → whole C-Section
 - Combinations are preferred otherwise volume overload leading to paraplegia occurs. Animal will not be able to stand up for long time too. So volume is reduced by combinations.

GENERAL ANESTHESIA

In large animals, it is somewhat risky. Some concerns are;

1. **Volume of Concentration:**
2. **Effect on Respiratory & Cardiac System:**
3. **Duration of these effects:**
4. **Economics:**

EXAMPLE#1: e.g Ketamine @15-30mg/Kg

- Suppose; Ketamine @20mg/Kg (5% Solution)
 - Animal Body Weight = 300Kg
 - Dosage: $300 \times 20 = 6000\text{mg}$
 - 1 vial of Ketamine: 10ml Rs: 220/=
- 5% solution means; 1ml for 50mg,
 - 10ml vial for 500mg
 - For 6000mg = 12 vials will be required; ($12 \times 50 = 6000$)
 - 1 vial of Ketamine: 10ml Rs: 220 So: 220×12 Rs: 2640/=

This amount is for first administration.

EXAMPLE#2:

- Suppose; Propofol (1%) @6mg/Kg
Animal Body Weight = 300Kg
Dosage: $300 \times 6 = 1800\text{mg}$
1 vial of Propofol: 20ml Rs: 350/=
- 1% solution means; 1ml for 10mg,
20ml vial for 200mg
For 1800mg = 9 vials will be required; ($9 \times 200 = 1800$)
1 vial of Propofol: 20ml Rs: 350 So: 350×9 Rs: 3250/=
- Effect is for 30-40 mint
- It is non-analgesic so analgesia is also required
So Butorphanol is used as analgesic @0.1-0.2mg → 1vial =Rs: 750/=
So at-least Rs: 4000/= → This amount is for first administration.

Recovery is checked, suppose Ketamine recovery time is several hours.

Ideal Anesthetic Agent:

- ✓ Should be Small volume administration
- ✓ Should have prolonged anesthetic effects
- ✓ Should have minimum risks
- ✓ Should have minimum effect on respiratory & cardiac system
- ✓ Should have rapid recovery
- ✓ Should be availability of antidote
- ✓ Should have less economic impacts

To meet all these requirements for large animals, a group was introduced called α_2 -adrenoceptors agonists or α_2 -agonists;

 α_2 -adrenoceptors agonists or α_2 -agonists

- ❖ Xylazine HCl
- ❖ Detomidine HCl
- ❖ Medetomidine HCl
- ❖ Dexmedetomidine HCl (Recently introduced in 2008-9)

Antidote: Yohimbin & Tolazoline 5mg/Kg I/V

These are for the whole group

Properties of α_2 -agonists:

- ✓ Small volume administration
e.g Xylazine Bovines= @0.02-0.05mg/Kg, Equines= @0.1-0.5mg/Kg
Animal Body Weight = 300Kg
Dosage: $300 \times 0.05 = 15\text{mg}$
1 vial of Xylazine: 25ml Rs: 700/=

- % solution means; 10ml/100mg,
- For light stage anesthesia, Dosage = 1.5-2.5ml (I/M)
- For deep stage anesthesia, Dosage = 2.5-3ml (I/M)
- 1st shot cost for Rs: 75/=
- Induction time = 90-120 mint (Remains anesthetic)
- This time is enough for small surgery
- ✓ Has good muscle relaxation effect (Ketamine + xylazine)
- ✓ Minimum effect on cardiac & respiratory system
- ✓ Have diuretic effect (Rapid recovery due to excretion)
- ✓ Has cerebral protection (cannot cross Blood-Brain Barrier)
- ✓ Decreases GIT motility (less motility = less fermentation so less pressure on lungs due to less gas production by fermentation)
- ✓ Diuretics
- ✓ Sedation
- ✓ Anti-convulsant
- ✓ Anti-anxiety

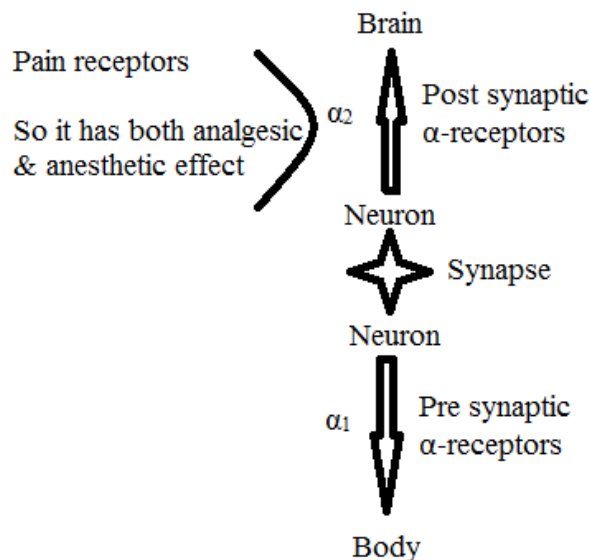
α -Receptors:

There are seven types of α -receptors;

- 1- α_{1A}
- 2- α_{1B}
- 3- α_{1C}
- 4- α_{1D}
- 5- α_{2A}
- 6- α_{2B}
- 7- α_{2C}

α -agonists	Inhibition
Xylazine HCl	α_{2A}
Detomidine HCl	$\alpha_{1A}, \alpha_{2A}, \alpha_{2B}$
Medetomidine HCl	$\alpha_{2A}, \alpha_{2B}, \alpha_{2C}$ & imidazole receptors
Dexmedetomidine HCl	$\alpha_{2A}, \alpha_{2B}, \alpha_{2C}$ & imidazole receptors

All have mild effect on α_1 receptors



- Opeoids inhibit μ -receptors (Morphine & Butyrophenon etc.)
- β -receptors are anxiety receptors which are inhibited by anti-anxiety drugs i.e Xanax & Ephedrine etc. ➔ Anxiolytic drugs

Limitations of α_2 -agonists:

- 1) Just after administration, it causes Dyspnea & decreases arterial blood pressure for 1-2 mint after that animal will be normalized
- 2) Cardiovascular effect: mild effect on arterial blood pressure on start after administration. Cardiovascular affects always depend on **Drug, Dose & spp. of animal**
- 3) Hormonal:
 - Decrease in ADH ➔ causes diuresis
 - Decrease in Insulin ➔ causes Hyperglycemia. Not recommended in diabetic ones
- 4) Decrease thermoregulation (Increased body temperature)
- 5) Decrease in Renin ➔ causes diuresis
- 6) Mild hematological effects ➔ heamolysis
- 7) Ocular effects (Mydriasis = Dilation of pupil)
- 8) ALL LIMITATIONS HAVE BEEN MINIMIZED IN DETOMIDINE

Xylazine-HCl:

	Bovines	Equines	Cat/Dog
Dose rate	@0.01-0.05 mg/Kg	@0.1-0.5 mg/Kg	@1-3mg/Kg
Dosage for 300Kg	1.5ml	15ml	--
Onset	I/M = 3-5 mint I/V = 3-5 sec	I/M = upto 15 mint	I/M= upto 10 mint

- ✓ Induction time = 90-120 mint
- ✓ Recovery time = 10-20 mint
- ✓ It should not be administered in pregnant animals because;
 - It can cross placental barrier ➔ death
 - It has oxytocin like effects that causes compression of fetus ➔ abortion

Medetomidine-HCl:

- **Dose:** Bovines = 0.02-0.1mg/Kg Equines = 0.2-1mg/kg
- Availability is 1% of 10mg, not available according to preferences so Xylazine is preferred

Dexmedetomodine-HCl:

Equines: I/V = @0.02-0.05mg/Kg I/M = 0.05-0.1mg/Kg

This group was especially formulated for equines. It is safest in equines. No risk of pregnant animals (It can be used in them). If animal is suffering from hepatitis, it shouldn't be given or given in combination. It is used in **combination** with Ketamine (10 times less than the dosage). **Onset time:** 5-10 mint (I/M) & 5-10 sec (I/V). **Induction time:** 60-90 mint. **Recovery time:** 10 mint. For 300Kg animal: 2ml Detmodine-HCl is required while 0.2ml Ketamine will be required which is 10 times less than the dosage.

Affections of Integumentary System

Integumentary System:

- Skin & appendages
- Appendages include;
 - Hair
 - Nail
 - Horns

Disbudding/Dehorning:

Disbudding	Dehorning
Bud removal	Horn removal
Before development of horns	After development of horns
Ideal age= 15-20 days. Upto 30 days, it can be recommended but after 30 days, it is not recommended because the growth of the horn is very fast after 30 days so we've to wait for the more 30 days for dehorning. (After development of horns).	After 2 months of age

Indications:

- Cosmetics
- To avoid injury to other animals
- Tumors or trauma etc.

Anatomy:

Upto 2 moth of age, skin (stratified Squamous epithelium) is present on the horns & Cornual process of skull is not attached but after 60 days they'll attach & horn will be developed.

Blood Supply: superficial temporal artery & dorsal branch of carotid artery

Innervated by: upto 6 month of age → Cornual Nerve while in adult more than 6 months of age → Cornual Nerve & Supra-orbital Nerve

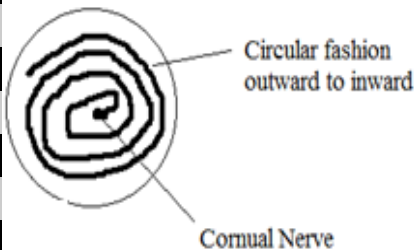
At the age of 4-6 month, these Cornual processes open into frontal sinus

Approach:

- i. Ideal age is 15-20 days
- ii. Lateral recombency
- iii. Local anesthetic infiltration i.e 2% Lignocaine or Lidocaine etc.

iv. Methods of Disbudding/Dehorning:**1. Chemical Method:**

- Most frequently used method
- Sticks of Caustic Potash (safe & mostly used), sodium potash & calcium potash are used
- Procedure:
 - Apply Vaseline around the base to avoid skin burn by burning effect of caustic potash
 - Move the stick in circular fashion movement from outward to inward direction to block Cornual nerve
 - When blood oozes out, we've to stop it because all the Squamous cells of the bud have been damaged so Cornual process will not be able to grow with skin cells because skin cells are checking its growth outward so no horn may develop.

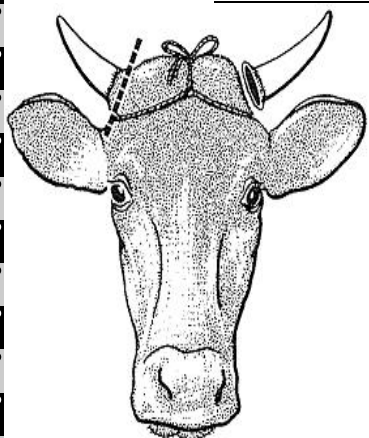
**2. Thermal Method:**

- Automatic system
- Device is attached to the horn & switched on
- There is fix temperature of 200°C which is get with slow heating of the device. When it becomes red it starts working
- Heated for 10 mint automatically

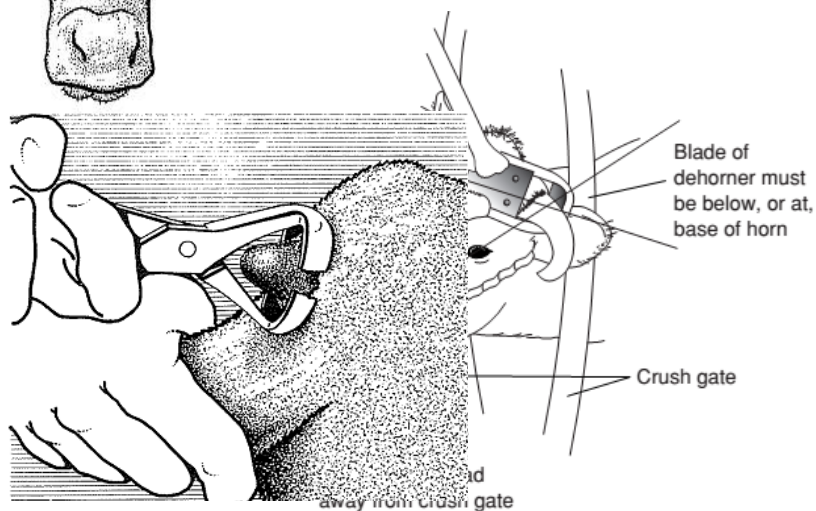
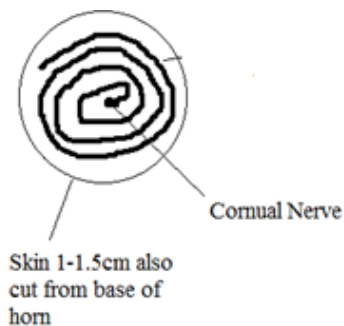
3. Corded Method:

- Electric device (Continuous electric current supply is needed)
- Actually this is dehorner
- Used after development of horns
- Simple electric cutter
- Temperature = 250°C
- Time: 15 sec
- 1-1.5cm skin from the base of horn is also cut

4. Butane-Powered Method:



- Butane gas is used
- Dehorner
- Temperature = 500°C
- Time: 5 sec
- Modified form of corded method which has ability to store electric current for sometime so may be portable



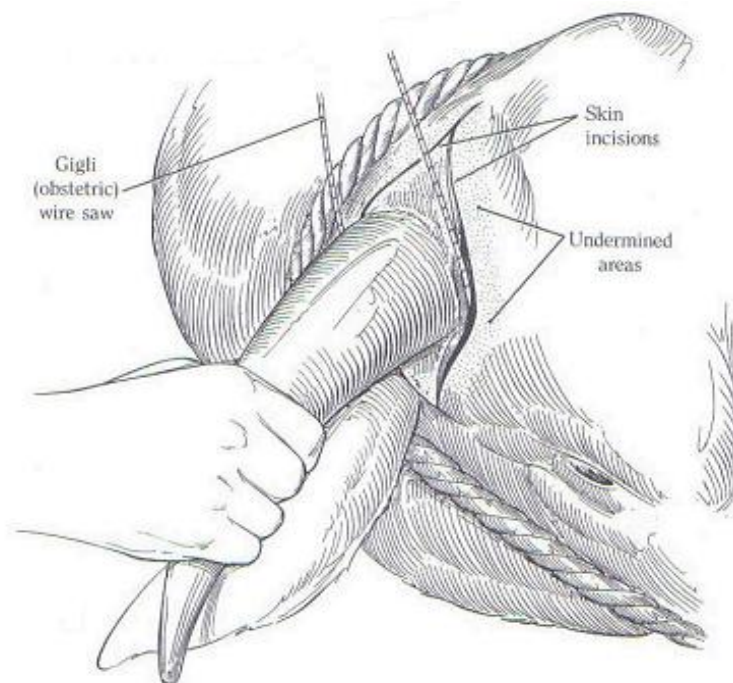
v. Cutting:

- Dehorner
- Gigli wire/obstetric wire

Vascular & A-vascular areas are checked to avoid pain & bleeding, horn is cut from A-vascular area.

Horn is griped in left hand & the warmth area is felt that is vascular area other portion is A-vascular.

There is possibility of re-growth



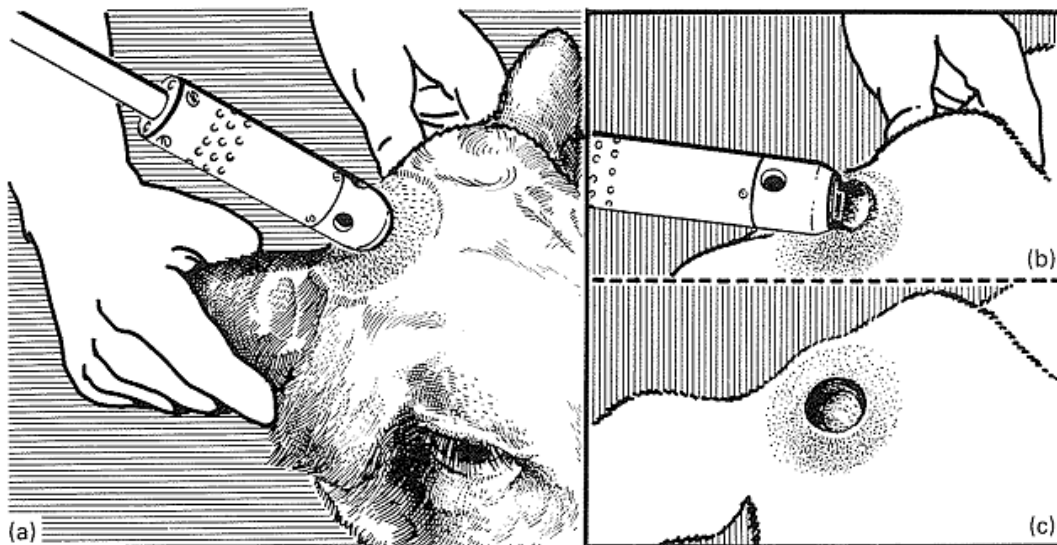
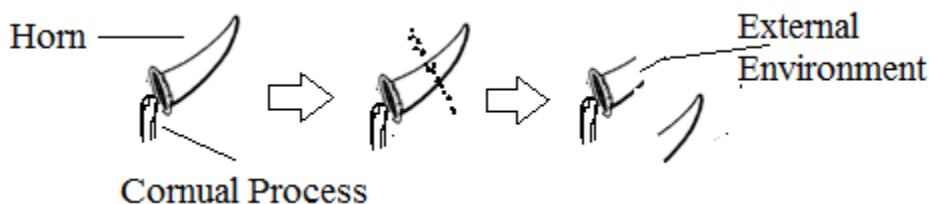


Fig. 2.48. (a) The disbudding iron, heated to a dull red heat, is applied over the horn bud with a stamping movement. Next, with a rotary movement a groove, 3 mm wide, is burnt through the skin at the base of and surrounding the horn bud. (b) The disbudding iron is angled and using the edge of the rim the horn bud is removed by searing it off the underlying frontal bone. (c) Horn bud removed. Note the circle of burnt skin round the base of the horn which has destroyed the corium and prevents any further development of horn.

Complications:

- Complication of wound like secondary infection
- Hemorrhages
 - Due to over rubbing of sticks or dehorner
 - Its treatment is carterizer or styptic agent to check the bleeding
- Sinusitis
 - Due to poor post-operative care of dehorning
 - Cornual process is exposed to the external environment



- Myiasis
 - Maggots in wound

Post-Operative Care:

- ✚ ASD bandages (Anti Septic Dressing)
- ✚ Antibiotics against Gram +ve bacteria i.e Streptococcus or Staphylococcus

For good results, apply following powders on dehorned parts → Quartz/silica.

Myiasis

“Formation of maggots in wounds”

Whitish / creamy color

Larvae of flies

Limitations:

- ✓ LARVAE:
 - They used to make the tunnels & contaminate the internal organs
 - After 24-48 hour, eggs hatch & after 2-3 days larva stage comes
 - Upto 10-12 days larval stage remains, then become fly & fly away
- ✓ FLIES:
 - *Musca domestica* (house fly / common fly)
 - *Musca autumnalis* (face fly)
 - *Hematobia irritans* (horn fly)
 - *Stomoxys calcitrans* (Stble fly)
 - *Cochlearrhy ominivorax*
 - New world Screw worms modern world, worm like fly, contagious, aerosol transmission

Benefits:

- ✓ These larvae produce acidic environment in the wounds, so there is no bacterial growth
- ✓ No pus formation because there they engulf pus
- ✓ **Bio-surgery:** Sterile larvae are produced in lab which cannot grow to fly, engulf the contamination on tumors by puncturing the tumor

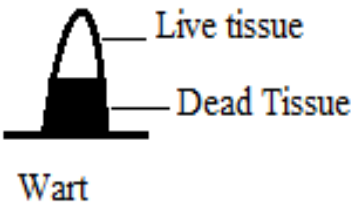
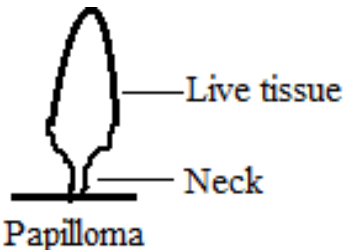
Treatment:

- ✓ Removal of maggots or larvae manually
- ✓ Use combination of Turpentine oil & chloroform in ratio of 1:4
- ✓ **Mode Of Action:**
 - TT oil cause irritation to larvae & chloroform decreases its oxygen level so larvae come outside so easily removed manually
- ✓ All of the larvae should be removed & after that inject S/C Ivermectin @ 0.2mg/Kg or 200 ng/Kg. In goats, the dose rate is doubled 0.4mg/Kg
- ✓ If high burden of larvae so at first manually remove the larvae then inject Ivermectin otherwise animal will be in anaphylactic shock because of excessive protein absorption by the body. (((HAKURA MOTATA means NO WORRY)))

Skin Tumors

- Melanoma → any of several benign neoplasms (usually of the skin) consisting of melanocytes
- Carcinoma → any malignant tumor derived from epithelial tissue; 1 of the 4 major types of cancer
- Fibroma → non-malignant tumor of connective tissue
- Papilloma → a benign epithelial tumor forming a rounded mass
- Sarcoids → (fleshy) of or relating to or resembling flesh
- Lipoma → a tumor consisting of fatty tissue

Tumor	General	Host	Site	Surgical Rx	Medical Rx
Melanoma	Benign in nature Dark grey pigmentation	Horse (Specially) Cattle (Rare)	<u>Equines:</u> -Base of tail -Vulval lips -Coronary Band <u>Cattle:</u> -Udder -Teat -Interdigital Space	Suturing is not recommended because it converts to malignant	Chemotherapy is done. It is actually anticancerous activity. -Vincristine sulphate @ 0.025 mg/Kg It is the abstract of <i>Rosa vinselina</i> . -Cisplatin @0.01 mg/Kg <i>Pheniramine melete</i> @ 1-5mg/Kg is used before anticancerous activity because it overcome the adverse reactions of anticancerous activity, it H1 & H2 receptor blocker & effective against vomiting too. Fasting is also recommended for 8-10 hours
Carcinoma	Commonly called Squamous cells carcinoma. Mostly benign but sometimes may be malignant.	Horse (Rare) Cattle (Mostly)	-Mucous membrane -Vagina -Vulvar lips -Eyes -Teat -Oral cavity	Surgical removal is applied but evaluate the vasculature to avoid more bleeding	
Fibroma	Exuberant growth Awkward growth Proud flesh (muscle fiber over growth a place & cross the skin,			Surgical removal	-Massaging with 10% copper sulfate, 3 times a day, 7-10 days -Soak or impregnate

	Reddish color seen from outside)			the bandages with carbolic acid , for 5-7 days
Pappiloma	“Condition on which papilloma occurs is called papillomatosis” <u>Family:</u> <i>papillomaviridae</i> <u>Genus:</u> <i>Pipapapilloma virus</i> <u>Size:</u> Few cm to inches It has neck & live tissue while wart has live & dead both type of tissues with no neck.  	<u>Surgical Removal:</u> <u>Partial excision:</u> 2-4 papillomas/warts are partially excised while others will be automatically cleaned <u>Complete excision:</u> 2-4 are completely excised while others will be automatically cleaned		-Vitamin E -Livamisole @1/3rd dose, 2.5mg/Kg for 3 days. Because its normal dose is 7.5mg/Kg so 1/3rd will be 2.5mg/Kg -Autogenous vaccine 20ml per dose for 3-5 days & check S/C <u>100ml autogenous vaccine formation</u> ✓ Take 5g live tissue ✓ Triturate in NS ✓ Add 5ml 10% formalin ✓ To increase its volume add Glycerol upto 100ml ✓ Add 200,000IU of penicillin in powder form. This 100 ml means 5 doses used in 3-5 days.
Sarcoids	Actually it is not a tumor but it seems like a tumor Unknown etiology. Pinkish color Sometimes it may contain pus Similar to fibroma in appearance. <u>Fibroma:</u> -Blood red in color -Muscles are involved <u>Sarcoids:</u> -pinkish + pus -skin (Epidermis & Mesodermis is involved)	<u>Sites:</u> -withers -Back of animal Its drawback is that it reduces the quality of hides <u>Treatment:</u> Injection of BCG vaccine, 7-8 ml in large animals BCG stands for; Bacillus Calmette-Guerin → Against TB		<u>Removal of proud flesh</u> - Carbolic acid - Electric cartrization - Silver nitrate (strong) - KMnO₄ crystals (moderate) - Tincture steel (moderate) - Tinc. Benzoin co. (mild) - Alum - Use of CuSO₄
Lipoma	Benign or malignant S/C fat accumulation Not affect the life Fat cells form nesting		Surgical Removal	Drugs not work because it is fat

Surgical Diseases of Eye

1. Squamous Cell Carcinomas (SCC)
2. Entropion
3. Ectropion

Anatomy:

- Upper eyelid
 - Blinking of eye is by the upper eyelid
 - Major role of nerves in this blinking phenomenon is by "*Lacrimal nerve*" & "*nasociliary nerve*"
 - Blinking is mainly comprised of ;
 - Closure of eye
 - *Orbicularis oculi muscle*
 - Voluntary or involuntary
 - Opening of eye
 - Levator palpebrae superioris muscle (*inferioris* on lower eyelid)
 - Damage to anyone of these muscles leads to opening or closing of eye permanently
 - Snakes don't have these muscles, so they don't blink their eyes
- Lower eyelid
- Globe of eye

Blood supply:

- ✓ Facial artery
- ✓ Transverse facial artery
- ✓ Supraorbital artery

Nerve supply:

- | | |
|---------------------|-------------------|
| ❖ Lacrimal nerve | ➔ to upper eyelid |
| ❖ Nasociliary nerve | ➔ to upper eyelid |
| ❖ Frontal nerve | ➔ to upper eyelid |
| ❖ Maxillary nerve | ➔ to lower eyelid |

Examination of eye:

Actually we examine two reflexes to check the movement of eye, even while the animal is anesthetized during surgery to check the stage of anesthesia.

These two reflexes are;

1. Palpebral reflex

- When lower eyelid is touched or pinched, the reflex is palpebral
- To check the eyelids

2. Corneal reflex

- When something is get closer to the eye, the response is due to corneal reflex
- To check the eye

ENTROPION

“Inward rolling of lower eyelid”

- It is not a disease
- It is condition, that may be;
 - **Primary**
 - Development of conditions only
 - Hereditary
 - **Secondary**
 - Due to some other problems
 - Conjunctivitis
 - Blepharospasm (spasm of the eyelid muscle resulting in closure of the eye)
 - Blepharitis (inflammation of eyelids)
 - Keratoconjunctivitis (inflammation of cornea & conjunctiva both)
 - Iritis (Inflammation of iris)

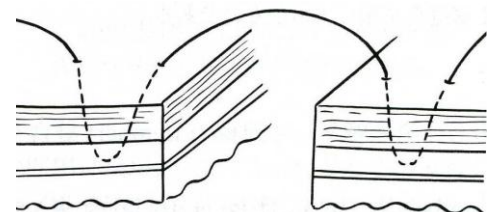
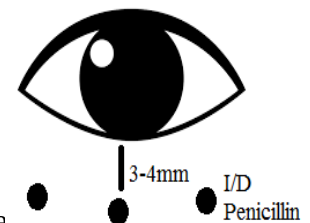
Treatment:

- ✓ Non-surgical treatment:
 - 3-4mm beneath the lower eyelid, penicillin or paraffin (antibiotics) are injected I/D at 2-3 different sites.
 - Pressure is induced actually & eyelid will open

- ✓ Surgical treatment:

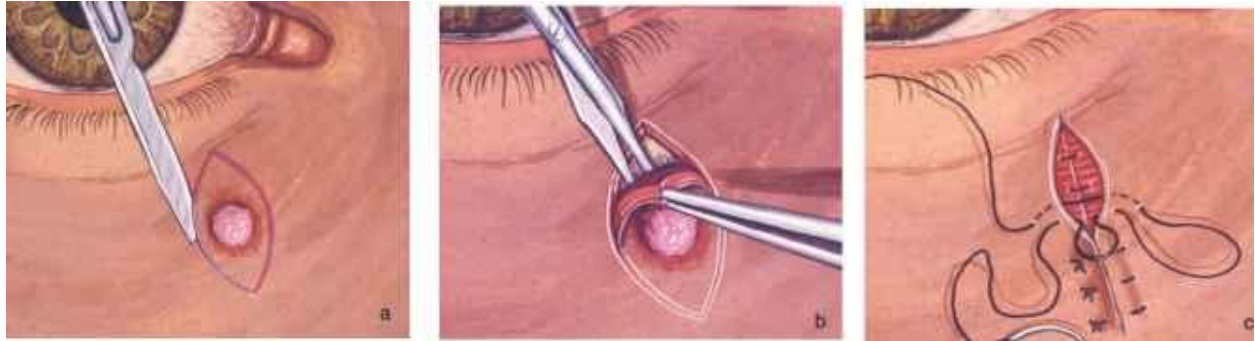
i. Temporary:

- Lambert suture pattern
- It will pull the eyelid outward by providing pressure
- Eversion of eyelid
- If Entropion is as a secondary condition, so it temporary because the main cause of it is something else



ii. Elliptical incision:

- Permanent
 - a- An elliptical Incision is given 5-6mm below the lower eyelid
- Length of elliptical incision is always twice of the width



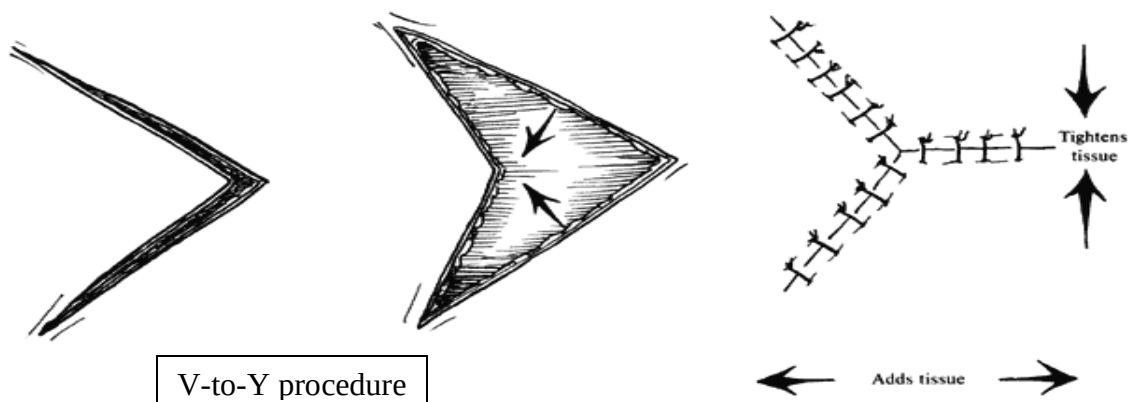
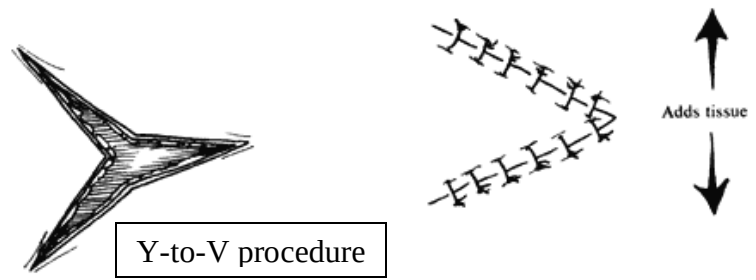
b- This flap of muscle will be removed

c- Remaining edges will be sutured

- This will also provide the pressure to pull the eyelid outward
- In primary conditions

iii. Y-to-V procedure:

- In severe cases, if more area is involved then this procedure is adopted
- Start it from a Y-shape incision
- Remove the flap of muscle within the Y-shape incision
- End it with V-shape suturing



ECTROPION

“Outward rolling of lower eyelid”

Treatment:

Surgical:

- V-to-Y procedure:
 - Start from V-shape incision
 - Remove the flap
 - End at Y-shape suturing

Diagnosis of both:

-  Lacrimation problem of eye
-  Eye swelling

Recommended sutures:

-  Non-absorbable
-  2/0, 3/0, 4/0 → according to size of animal
-  Silk can also be used

Anesthesia:

-  General or Local infiltration (Both will be used according to location, severity & size)
-  Cocaine eye drops can also be used.
-  Sand bags can also be used to raise the head of animal

Blepharitis

“Inflammation of eyelids characterized by redness & swelling”

Etiology:

Un-hygiene

Treatment:

Washing of eye with luke warm water or NS

Squamous cell carcinoma

It is the most common tumorous condition of eyes in equines. It involves eyelids and 3rd eyelid & sometimes globe too. It is most common in lower eyelid. It occurs more in non-pigmented horses. Animal kept for draught purpose has this more condition more commonly. Common in racing horses.

In bovines, it is more common in high productive cattle, along with non-pigmented cattle. Age factor is also there. In older animals, 8-11 year, both in bovines & equines it becomes common.

Appearance:

It is viable. When it is small, it is just like inflammation of eyelid or 3rd eyelid. But as it progresses, it happens to be a tumorous growth. In full size, shape varies for different animals.

Treatment:

Chemotherapy

- Vincristin sulphate @ 0.025mg/Kg with dilution I/V in bovines & equines
- Cisplatin @ 3.3mg/Kg
 - Or topical use, 1mg/cm³ area infiltrated into tumorous growth
 - Four times infiltration at interval of 2 weeks for 100% success rate.

Hyperthermia

- Electrocauterizer
 - Probe kept on margin of growth
 - 50°C for 30 sec at one site
 - After 7-10 days, it will slough off but it doesn't work in large growths

Cryosurgery/therapy

- Liquid nitrogen is used for removal of SCC from eye with 80% success rate
- Probes are present, cut it, if small
- If large growth, first debulk it by any method then apply this method.

Radiation therapy

- It is done through different isotopes in which β -radiation is used
- Strontium-90, Iridium-192, Gold-98,
- Success rate is 70-90%
- It is just like laser therapy. It will slough off in 5-7 days
- Used for tumorous growth up to 2mm

Immune-therapy

- BCG (Bacillus Calmette Guerin): local infiltration into tumorous growth
- In case of SCC, there is only one report of successful result
- But this is a successful treatment in sarcoids

✚ Surgical removal/surgical excision

- Possible in standing animals.
- In aggressive animals, we can do it in lateral recumbency
- Sedation along with optic nerve blocking
 - Auriculo-palpebral (more used)
 - Retrobulbar
 - Optic nerve
- We have to excise the growth surgically along with some part of eyelid. 1/3rd eyelid towards lateral canthus can be removed. Then perform suturing.
- This is the mostly used method.

Trichiasis

If there is hair that penetrates the cornea of the animal OR growth of hair on cornea OR if growth of any hair of eyelashes grows inward.

That has to be removed.

- ≡ Electro-epilation
 - Removal of hair follicles
- ≡ Cryo-epilation
 - Liquid nitrogen or nitrous oxide

Distichiasis

Tarsal gland is normally present in eyelids in large numbers. It's development starts which disturbs the eyes & causes irritation. So we have to remove gland by cryosurgery or electro-surgery.

Enucleation of Globe

"Removal of eye"

Indications:

- ✚ Microphthalmia
 - If there is atrophy of eye. It could lead to entropion or ectropion. Conjunctivitis may also lead to it.
- ✚ Inflammatory conditions
 - If it is not caused by any therapy
- ✚ Intraocular injection
 - Which creates blindness of eye

Prosthesis:

Artificial eye

18-22mm in Dogs

- ✚ Any **Neoplastic condition**
 - Especially squamous cell carcinoma which mostly occurs in eye
- ✚ Any **Ocular discomfort**
 - Which is failed by medical therapy
- ✚ Trauma
 - That destroys the whole eye
- ✚ Proptosis of eye
 - Forward or outward displacement of eye (bulging outwards)

Anesthesia: Mild sedation with local infiltration at 3-4 different points 3-4mm apart.

Nerves:

- ≡ Retrobulbar Nerve
 - Going on caudal side of globe, on the lateral sides
- ≡ Optic Nerve
- ≡ Auriculopalpebral Nerve
 - It is a nerve that leads towards ear. Palpebral branch is from *Zygomatic arch* where we can locate it.

Approaches:

- ❖ **Transconjunctival**
 - If there is no involvement of eyelids.
 - Incise where conjunctiva ends & mucous membrane is attached (use curved, blunt-blunt scissors)
 - Then ligate the optic nerve & vasculature
 - Then remove the globe
 - Suture conjunctiva with each other
- ❖ **Transpalpebral**
 - If eyelids are also involved with conjunctiva
 - Approach the transpalpebral & also eyelids
 - Remove conjunctiva, eyelids & *cal-da-sac*
 - We can close eye either by allis forceps or suturing
 - Complications:
 - Hemorrhages
 - Certain other complications because of it
 - Formation of dead-space
 - We should suture until it gets healed
- ❖ **Lateral//Approach of optic nerve**
 - Approach from medial to lateral curvatures
 - Hold the globe & palpate the nerve. Animal will show some response.

Respiratory System

Impactions/Conditions/Indications:

- ✚ Nasal polyps (over growth of mucous membrane)
- ✚ Atheroma (sebaceous cysts that are found in false nostrils in equines)
- ✚ Guttural pouch empyema
- ✚ Guttural pouch tympany
- ✚ Guttural pouch mycosis
- ✚ Laryngeal hemiplagia/paraplegia
- ✚ Soft palate paralysis
- ✚ Cleft palate (congenital abnormality)
- ✚ Nasal septum abnormalities (any abnormality in nasal septa)
- ✚ Pharyngeal abscess

Sinusitis in Horses:

Just like in case of flu, headache & tears come due to blockage of sinuses. In **Peafowl**, infra-orbital sinusitis is caused by *Mycoplasma gallisepticum*. In them sinus blocks & pus formation occurs. Similarly, in equines, sinusitis occurs. It happens in bovines but less or very rare as compared to horses.

Indications:

- ✚ Infection of URT (upper respiratory tract)
- ✚ Tumor
- ✚ Cyst formation
- ✚ Parasites (maggots come out of nose while sneezing → Nasal bots). And penetrate in maxillary and frontal sinus.

Clinical signs:

≡ Swelling of sinuses

Treatment:

- ✓ Trephining of sinusitis:
 - Small procedure
 - Make a hole in surroundings by a trephine which has sharp ends to penetrate it.
 - If more than one sinus are affected then a large surgery is performed.

SINUS

1. Frontal
2. Maxillary
 - ✓ Anterior
 - ✓ Posterior
3. Infra-orbital
4. Splenopalatine
 - ✓ Where ramus is present

- ✓ Clipping of sinus
- ✓ Antibiotic therapy for 3-5 days
- ✓ Flushing
 - After evacuation, flush with KMnO₄ dilution 1:1000 or Nitrofurazolidone (Furaxone® or Dependol® syrup)

Tracheotomy/Tracheostomy:

It is an emergency case falling n emergency surgery. Mostly we don't have time to make the area aseptic.

≡ **Indications:**

- ✚ URT problems exist that could lead to Dyspnea in animals

≡ **Approach:** Standing position but it is skill based

≡ **Anesthesia:** If animal is aggressive then give mild sedation. It can be performed by simple infiltration of lignocaine & by light sedation.

≡ **Procedure:**

- ✓ If we have time, proximal site is approached (starting from where mandible completes and neck starts i.e starting of neck from bifurcation of jugular vein, it should go half of the neck)
- ✓ 4-5 inch on lateral side of trachea
- ✓ Make area aseptic by scrubbing or hair dipping
- ✓ Incision on skin, 6-7.5cm up to 3 inch longitudinal (parallel to trachea/along the tracheal length) with the help of scalpel
- ✓ Incision on ***Sternocephalicus muscle*** is done
- ✓ Approach trachea, as it has tracheal rings/C-shaped cartilages called **inter-annular liament** (i.e semi-linear shaped ligament whitish in appearance.)
- ✓ Stable incision given in transverse fashion in between C-cartilages
- ✓ Put 2 fingers in between two cartilages or we may use manual retractor/blade/scalpel
- ✓ In prolonged tracheotomy, incision is extended in the form of elliptical incision
- ✓ Sometimes proximal and distal cartilages are also taken in incision.
- ✓ Administer tracheal tube in downwards orientation towards the lungs
- ✓ Cut 2-4 cartilages by making "Stoma" in it.
- ✓ **Temporary solution:**
 - Fix it by adhesive tape → no suturing
- ✓ **Permanent solution:**
 - Fit it with skin by suturing with skin to avoid contamination

Post-Op care:

- ♣ First 3-5 days of surgery, twice a day. Irrigation should be done in normal routine but sometimes more complications can occur.
- ♣ There may be secretions, mucous discharges, blood clot at lumen area that may result in complications
- ♣ For permanent tube, mucous is sucked outwards by suction pump or syringe
- ♣ For temporary tube, old tube is pulled out & replaced by a new one in every 12 hour
- ♣ After 7-15 days, temporary tube that we have pulled out, after it suture tracheal rings. Tracheal tube must be of small lumen i.e 20-28 inch tube
- ♣ As we have given a straight incision/secondary incision, healing is necessary that will take 7-10 days
- ♣ Antibiotic therapy for 3 days after initial surgery, when we have administered tube
- ♣ For tetanus, ATS/Toxoid is administered after surgery in equines & bovines.

Permanent Tube	Temporary Tube
Made up of stainless steel/ceramics	Made up of polyurethane
Less in length	More in length
It just gives passage	In it inserted inwards
Tube doesn't go inside	Tube goes inside

Guttural Pouch in Horses

Conditions associated with them and their treatment**What are Guttural Pouches???**

- These are;
 - Enigmatic
 - Air-filled
 - Mucus-secreting extension of the eustachian tubes
- Capacity of air in adult horses is about 300–500ml.
- Present in Perissodactyls (odd-toed ungulates) such as;
 - Equidae e.g. horses, zebra, asses
 - Tapirs e.g. *Tapirus terrestris*
 - Rhinoceros e.g. *Baluchitherium*



Physiological Function:

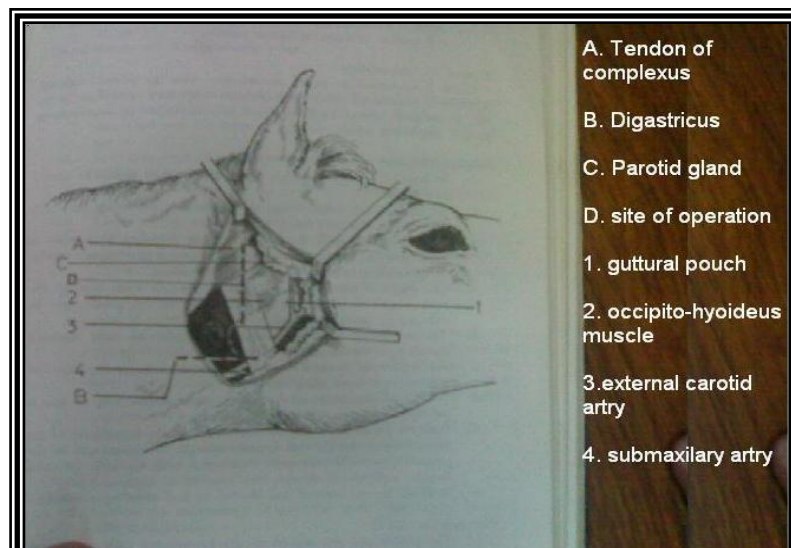
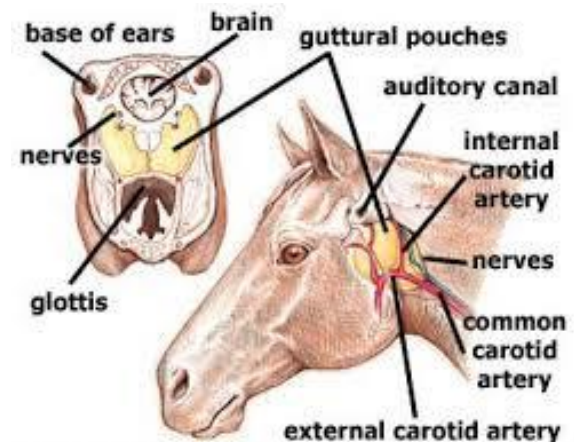
- ✚ It has unknown physiological function
- ✚ Recently, it is proposed that they might function during selective brain-cooling (SBC)
- ✚ SBC help in maintaining the core temperature of internal carotid artery (ICA) during hyperthermia
- ✚ ICA arise from common carotid artery (ICA and ECA)
 - ICA supplies blood to brain
 - ECA supplies other portion of head i.e. face, scalp & meninges etc.

Anatomy:

- ✓ Ventral diverticulum of eustachian tubes
- ✓ The guttural pouches are paired mucous sacs
- ✓ Separated from each other through;
 - Rectus capitis ventralis muscle
 - Longus capitis muscle
 - Median septum
- ✓ Connect the pharynx to the middle ear

Borders:

- ♣ Rostrally;
 - Basisphenoid bone
- ♣ Ventrally;
 - Retropharyngeal Lymph Node
 - Pharynx
 - Oesophagus
- ♣ Caudally;
 - Antlantooccipital joint
- ♣ Laterally;
 - Digastricus muscle
 - Parotid and mandibular salivary glands
- ♣ Dorsally;
 - Temporal bone
 - Tympanic bulla
 - Auditory meatus



- ♣ Each pouch is divided in three compartments as;
 - Dorsal
 - Medial
 - Lateral
- ♣ Dorsal compartment contains;
 - Vagus and sympathetic nerves
 - Internal carotid artery and
 - Ventral cerebral vein
- ♣ Communication of pouch with pharynx is through pharyngeal orifice of eustachian tube

Functions of Guttural Pouches:

- ✚ Lined with pseudostratified ciliated epithelium containing goblet cells
- ✚ Its mucosa has ability to;
 - Protect the horse from ear infections
 - Trapping bacteria that enter eustachian tubes
 - Clear foreign bodies etc.
- ✚ Various immunoglobulins are found in its mucosa
 - IgG found in GP lymph nodes
 - IgM scattered in GP submucosal L.N.
 - IgA present in surface layer of mucosal epithelium

Associated Conditions with GP:

Three conditions are usually found;

1. Guttural pouch tympany
2. Empyema of guttural pouch
3. Guttural Pouch Mycosis

Guttural Pouch Tympany:

Pharyngeal opening of the Eustachian tube act like a one-way valve. Air can get in, but it cannot get out. This condition usually occurs in only one pouch, but it can affect both.

Diagnosis:

- ≡ Not difficult to diagnose
- ≡ Characteristic swelling in the throatlatch.
- ≡ May use X-rays and/or perform an endoscopic examination to confirm the diagnosis and determine which guttural pouch is involved.

Endoscopic examination of the guttural pouches:

- ≡ It is the best (often the only) way to diagnose guttural pouch disease and determine the optimal approach to treatment.



Guttural Pouch Empyema:

- ≡ The presence of pus in the pouches caused by bacterial growth.
- ≡ More common than tympany.
- ≡ Usually occurs following an infection of the pharynx.
- ≡ Most common organism involved is *Streptococcus equi*,
 - The causative agent of strangles.

Diagnosis:

- ≡ suspected in any horse with a persistent white to yellow discharge from one nostril.



Guttural Pouch Mycosis:

- Fungal infection predilection for dorsal wall (roof)
- Involve one.....rarely both
- Generally associated with fungal species of primary pathogens
- Immunosuppressed horses
- Receiving long-term antibiotic therapy
- Usually associated with *spp. Aspergillus*



Diagnosis:

- ✚ Typical lesion is diphtheritic membrane (a membrane of coagulated fiber with bacteria and leukocytes. It is usually white or grayish yellow with well-defined margins)
- ✚ Endoscopic examination
- ✚ Neurological signs
 - Horner's syndrome etc. (a pattern of symptoms occurring as a result of damage to nerves in the cervical region of the spine (drooping eyelids and constricted pupils and absence of facial sweating))
- ✚ Arterial signs
 - Unilateral/bilateral nose bleeding (epistaxis)
- ✚ Culture
- ✚ Fungal mycelia are found on histopathologic exam.

Predisposing sites

- ♣ Roof of the medial compartment; Caudal and medial to the temporohyoid articulation
- ♣ Lateral wall at the lateral compartment

Radiographic examination

- ♣ Partial fluid filled
- ♣ Bony exostosis.
- ♣ Osteolytic changes of the stylohyoid bone

Chondroids**Indications:**

- ✚ Guttural pouch empyema
- ✚ Food material in the pouch
- ✚ Guttural pouch tympany
- ✚ Presence of chondroids
- ✚ Horses of all age, breed or gender are susceptible
- ✚ Warm/stabled horses are more commonly affected

**Anamnesis:**

- ❖ Epistaxis
 - Unilateral
 - Bilateral
- ❖ Neuropathies
 - Horner's syndrome
 - Laryngeal hemiplegia
 - Soft palate paresis
 - Pharyngeal paralysis
 - Facial paralysis

Epistaxis**Clinical Signs:**

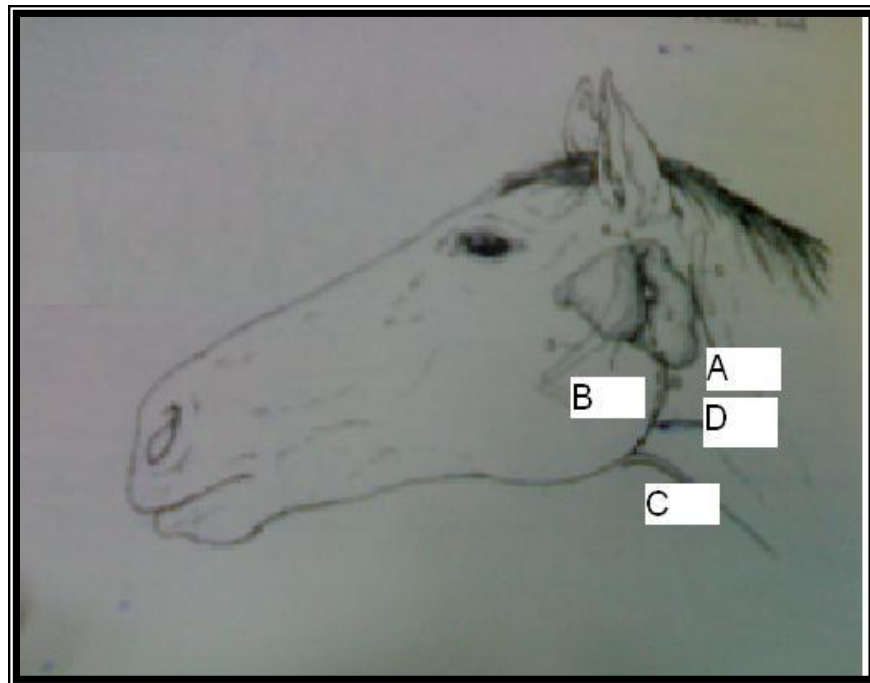
- ✓ Warm skin over the affected area
- ✓ Unilateral or bilateral epistaxis
- ✓ Purulent nasal discharge
- ✓ Ingesta in nasal passage
- ✓ Dyspnoea (difficult, open mouth breathing)
- ✓ Polypnoea (increased respiratory rate)
- ✓ Coughing
- ✓ Snoring (abnormal breathing sounds of URT)
- ✓ Cervical pain
- ✓ Head shaking
- ✓ Weakness and atrophy of head, face and tongue
- ✓ Stiffness or extended neck
- ✓ Drooping (paralysis) of ear
- ✓ Laryngeal/tracheal/pharyngeal swelling
- ✓ Tongue weakness or paralysis
- ✓ Dysphagia
- ✓ Vomiting or regurgitation
- ✓ Exercise intolerance
- ✓ Hyperhidrosis (excessive sweating)
- ✓ Ptosis (drooping of upper or lower eyelid)
- ✓ Prolapse of third eyelid (protrusion nictitating membrane)
- ✓ Corneal ulcer

Prognosis:

- ≡ Regression of the mycotic lesions occur in 2-4 months
- ≡ 50% of the untreated cases die due to fatal hemorrhage
- ≡ Horses with epistaxis has good recovery
- ≡ Horses with paralysis have graved prognosis

Approaches to guttural pouch:

- There are 4 method to approach the guttural pouch:
 - A. Hyovertebrotomy approach (dorsolateral)
 - B. Viborg's triangle approach (ventrolateral)
 - C. Whitehouse approach (ventral)
 - D. Modified Whitehouse approach (paramedian)
- Retractors are required for these procedures.

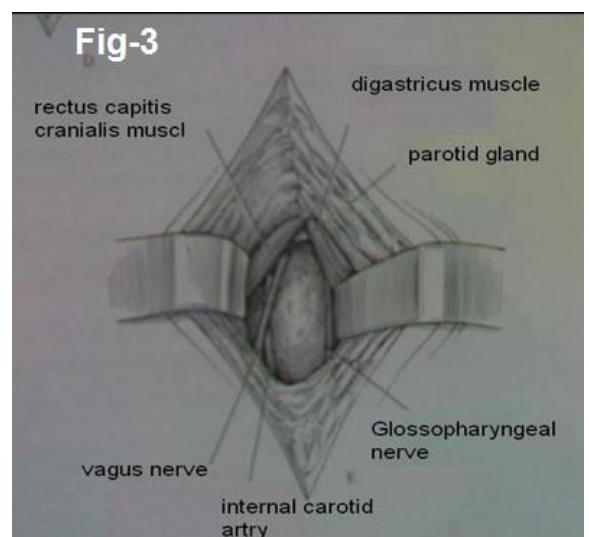
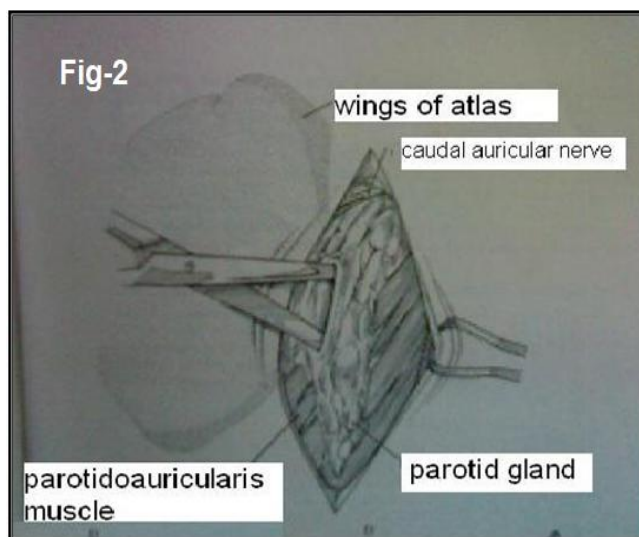
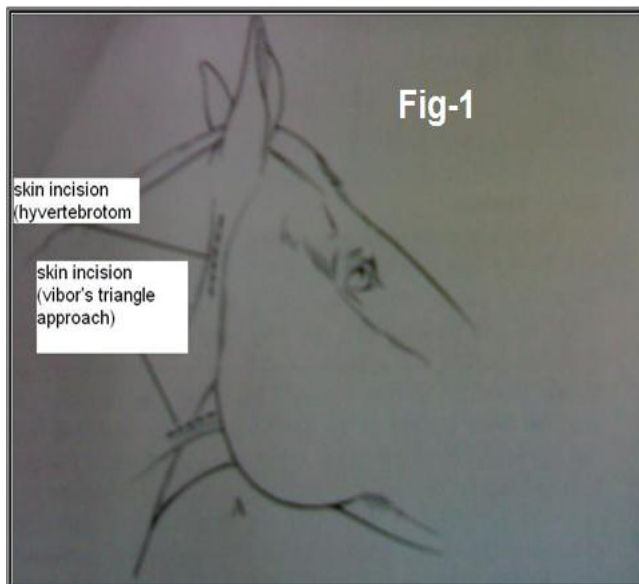


Control and Anesthesia:

- Horse is controlled in lateral recumbency with the affected side up
- Anaesthesia is achieved by
 - Administering general anesthetic agent i.e. Pentothal Na @ 13-30 mg/kg BW or Xylazine HCl
 - Infiltration with local anaesthetic (lignocaine HCL @ 0.2-0.5 mg/kg) at the site of operation

1. Hyovertebrotomy

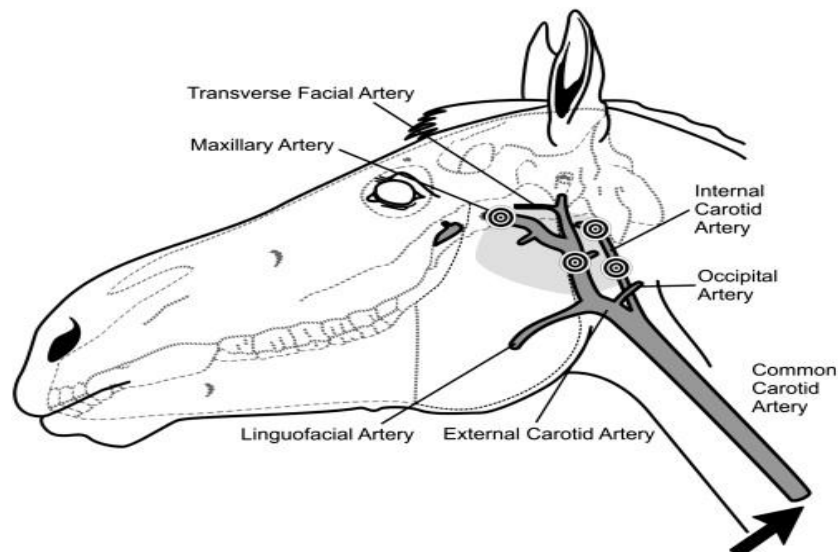
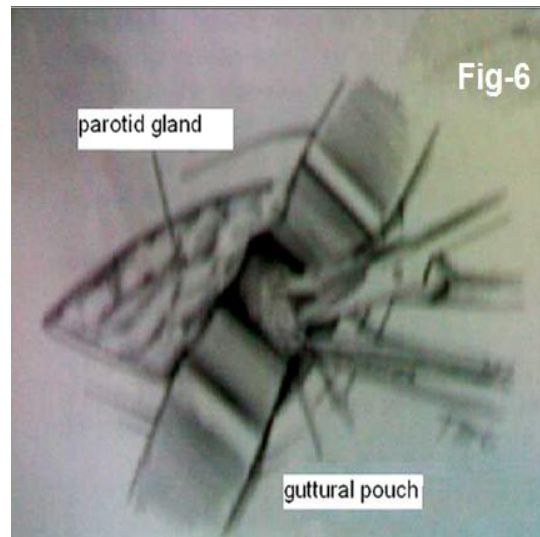
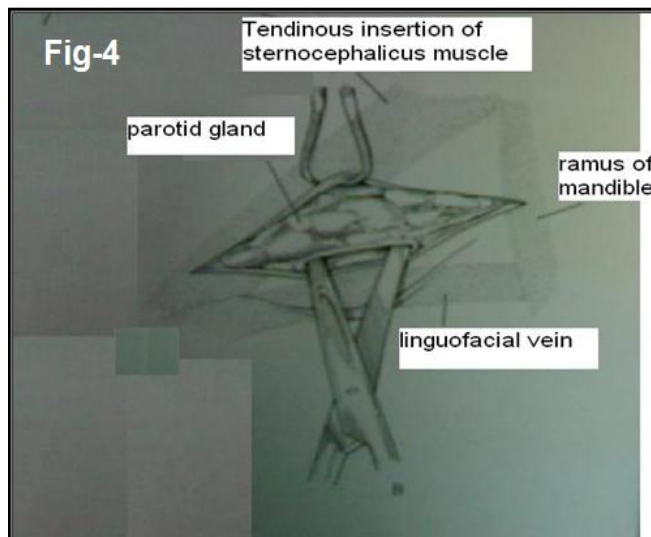
- ✚ A 10 cm long incision is made;
 - 2 cm cranial and parallel to the wing of Atlas (fig-1)
- ✚ Parotid salivary glands and overlying parotido-auricularis muscles will be exposed
- ✚ Incise ventral part of parotido-auricularis musc. (fig-2)
- ✚ Reflect the parotid gland cranially
- ✚ This will lead to;
 - Occipitohyoideus and digastricus muscles craniodorsally
 - Rectus capitis cranialis muscles caudodorsally (fig-3)



- ✚ Blunt dissection through areolar tissue
 - Caudal and medial to the occipitohyoideus-digastricus muscle group
 - Expose the dorsolateral wall of the guttural pouch.
- ✚ Puncture the guttural pouch with close tip of scissors
- ✚ Enlarge the opening by separating its edges
- ✚ Deal with the respective condition

2. Viborg's Triangle Approach

- ✓ Bordered by;
 - Tendon of the sternocephalicus muscles (dorsally)
 - Linguofacial vein (ventrally)
 - Vertical ramus of the mandible (rostrally) (fig-4)
- ✓ 4-6cm skin incision dorsal & parallel to linguofacial vein located at border of the mandible (fig-1)
- ✓ Reflect the base of parotid gland dorsally (if necessary) (fig-6)
- ✓ G. P. will be exposed
- ✓ Grasp the membrane of G. P. with forceps and incised with scissors (fig-6).



3. Whitehouse Approach

- ✚ Dorsal recumbency
- ✚ Skin incision is made on the ventral midline over the larynx
- ✚ Dissection is continued b/w the paired sternohyoideus and omohyoideus muscles and along the larynx to the affected guttural pouch.
- ✚ The guttural pouch is opened medial to the stylohyoid bone
- ✚ Care is taken to avoid the pharyngeal nerve, which are very close to incision.

4. Modified Whitehouse Approach

- ✓ Incision is made along the ventral edge of the linguofacial vein
- ✓ Extends rostrally for about 12 cm from the jugular vein
- ✓ The underlying fascia is incised to expose the lateral aspect of the larynx.
- ✓ Blunt dissection is continued until the G. P.
- ✓ Major advantage of this modification is;
 - Dissection is through a natural facial plane
 - Dose not involve an incision b/w the sternohyoideus and omohyoideus muscles.

Advantages of both Whitehouse & modified Whitehouse approach:

Both Whitehouse and Modified Whitehouse approaches allow direct access to;

- ♣ Roof of the guttural pouch
- ♣ Digital exploration of the lateral compartment
- ♣ Provide excellent ventral drainage, and
- ♣ Simultaneous access to both pouches through septum

Drainage:

- ≡ The wound is left open for drainage and/or a drain is inserted.
- ≡ The drain typically passes out;
 - Hyovertebrotomy incision dorsally
 - Viborg's triangle incision ventrally
- ≡ The surgical wound heals by granulation (second intention)

Suturing:

- Suture the G. P. membrane with simple interrupted sutures
- Synthetic absorbable suture material e.g. polyglactin 910 should be used
- Appose the fascia associated with the parotid gland

Postoperative care:

- Skin incision should be left open to heal by second intention
- The pouch and the wound should be irrigated daily with non irritant antiseptic solution till healing
- Anti-tetanus serum/toxoid should be administered after surgery
- Antibiotic course against Gram positive for 4-5 days

Prognosis

- Prognosis is favourable when complete drainage and removal of contents is performed.

Digestive System

Surgical Interventions of GIT

“Affections of GIT” means “Surgical corrections of GIT”

Esophagus:

“Esophagotomy”

Length of Esophagus:

Length of Esophagus from Pharynx to cardiac end of stomach	
Bovines	90-110 cm
Caprine	45-50cm
Horse/Mule	120-150cm
Donkeys	60-70cm

Location:

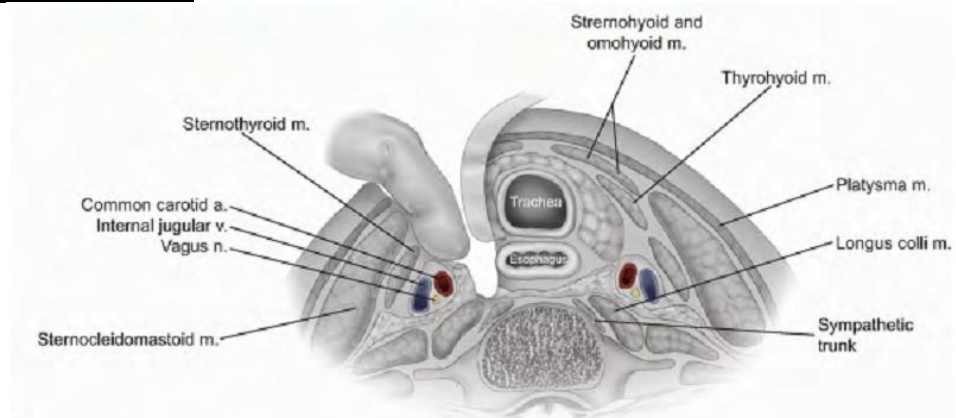
Esophagus is divided into two parts on the basis of location; (Trachea is considered as Land Mark.

	Cervical Esophagus		Thoracic Esophagus
Length	From Pharynx to thoracic inlet		From thoracic inlet upto cardiac end of stomach
Location	First 1/3 rd part	Next 2/3 rd part	C ₆ -C ₇
	Dorsal to trachea Atlas to C ₃	Lateral to trachea C ₃ to C ₆ /C ₇	Near to the thoracic inlet, it is started dorsolaterally. From thoracic inlet, upto bifurcation of trachea, it remains dorsolateral to trachea. After that dorsal to the apex upto the diaphragm.

Hiatus: “Opening of esophagus & its accompanied structure, pass through it”

Accompanied Structure of Esophagus:

- Vagus nerve
- Carotid artery
- Jugular vein
- Lymphatics
- Trachea



Histology:

Four layers

Cervical Esophagus	Thoracic Esophagus
Tunica adventitia	Tunica serosa
Tunica Muscularis*	Tunica Muscularis*
Tunica mucosa	Tunica mucosa
Tunica submucosa*	Tunica submucosa*

* Have holding capacity of suture material while others don't have.

Blood Supply:

- ✓ Esophagus is supplied through Carotid Artery → then by cranial thyroid artery → then by Broncho-esophageal artery
- ✓ Drained through Jugular Vein → then by Cranial Vena Cava → then by Thyroid veins

Nerve Supply:

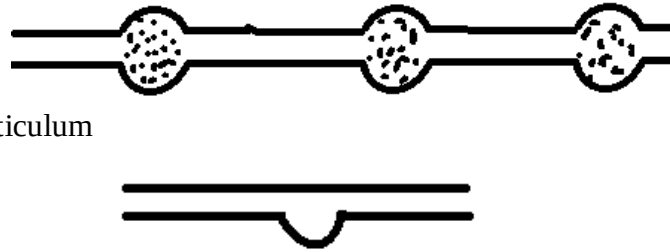
- ✓ Cranial part is innervated by Vagus Nerve
- ✓ Thoracic part is innervated by Bronchial nerve
- ✓ Along with Laryngeal Nerve.

NOTE: Vagus Nerve is the longest & thickest nerve of the body while Sciatic Nerve is the 2nd longest nerve of the body. **Ligament nuchae** is largest ligament.

Indications for Esophagotomy:

Why to perform Esophagotomy?

- Chocking (more in equines)
- Perforation
- Tumors
- Stenosis (Narrowing of lumen) → mostly due to sloughing off
- Mega-esophagus (Congenital or Acquired)



➤ Esophageal Diverticulum

Approach: It varies according to position

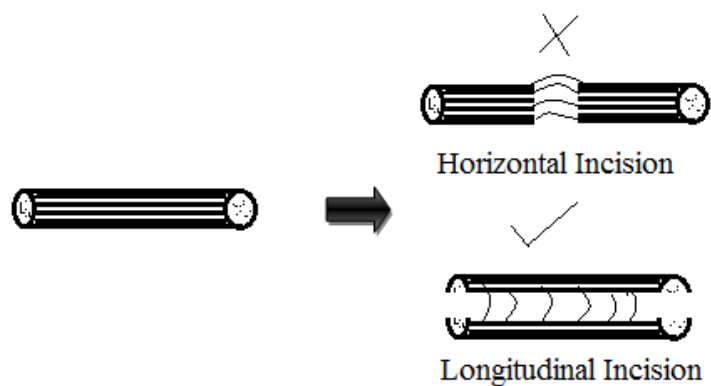
Anesthesia: General anesthesia or sedation depending upon history

Recumbency: Mostly standing but sometimes may be recumbent

✚ Incision Approach: Longitudinal incision

○ Why longitudinal incision?

- Because layer of Tunica Muscularis are longitudinal & when sutured, suture material will be held. In case of horizontal incision, when sutured, suture material will not be held.



Preoperative care:

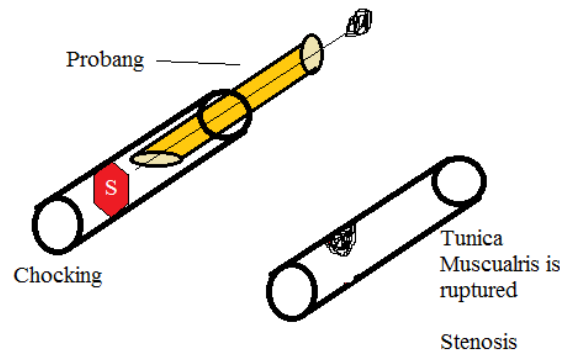
- ✓ Aseptic environment
- ✓ Sterilized gloves & instruments
- ✓ Minimum incision
- ✓ Control of hemorrhages
- ✓ Knowledge of anatomy

Procedure:

Pre-surgical medication:

- If the animal is not pregnant, oxytocin can be used which is a good smooth muscle contractor

- Probang is used in case of choking
- After choking, tunica Muscularis may rupture followed by Stenosis. Antispasmodic drugs i.e primaverine (vet) & dorotaverine (human) are used for Stenosis.
- Anti-milking Method:
 - Stretch the neck
 - Use the finger or hand
 - Against the gravity
- This is the mechanical method
- After that, surgery is conducted



Surgery:

- ❖ Identify the esophagus (Reddish & Longitudinal fibers)
- ❖ Locate the impaction site
- ❖ Longitudinal incision
- ❖ Suturing:
 - Closure: closed into two layers
 - 1st layer is Internal suturing
 - T. mucosa & T. submucosa
 - 2nd layer is External suturing
 - T. Muscularis & T. adventitia (in cervical region)
- ❖ Suture Material:
 - Absorbable
 - Minimum requirement of 60-90 days for absorption
 - Mono-filamentous
 - No contamination due to capillary action
 - Early healing
- ❖ Internal Suture pattern:
 - Simple continuous
 - Because minimum suture can be sutured & less diameter is involved
 - Everted
 - If inverted pattern is used that may cause adhesion to other wall of the esophagus & lead to Stenosis
- ❖ External Suture pattern:
 - Simple continuous
 - Simple Inverted
 - Because the external layer should be much secured
 - T. Muscularis & T. serosa/ T. adventitia
 - Absorbable suture material
 - Mono or multi filamentous
 - Polyglactin-910 (size= 2/0, 3/0)

- 60-90 days absorption time
- ❖ Knotting
 - Buried knots in all layers
 - Can't be seen from outside
- ❖ Drainage:
 - Apply drainage tube between S/C & mucosa
 - One eye should be out of esophagus
- ❖ Skin suturing (Non absorbable suture material & simple continuous or interrupted)

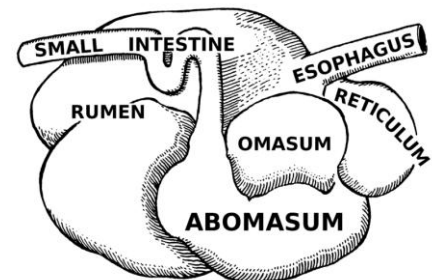
Postoperative Care (3-5 days):

- ✓ ASD & Irrigation of drainage (Cleaning)
- ✓ For 1st three days, broad spectrum antibiotics (Gram +ve /-ve)
- ✓ Analgesia → Flunixin, Ketoprofen, Niloxin, Peroxicam etc.
- ✓ Dextrose 5% or 10% (25-30ml/Kg infusions for three days to meet feed requirements)
- ✓ Milk or cerelac for 3-5 days per os
- ✓ After 5 days when animal is shifted to normal feed provide soft feed like fodder etc. depending upon the conditions & after observing the ingestion.

RUMENOTOMY

Anatomy:

- | | |
|--------------|-------------------------|
| 1. Rumen | } On left side of body |
| 2. Reticulum | |
| 3. Omasum | } On right side of body |
| 4. Abomasum | |



Note: In camels, Omasum is missing & fused with Abomasum

Rumen	○ Largest component ○ Act as storage house ○ Storage: Average fodder 40Kg & water 40 liter ○ Location: Left side, starts from 7th to 8th rib & ends at Prepubic region
Reticulum	✓ Lies parallel to diaphragm ✓ On left side of body ✓ Ventral to rumen ✓ Location: 8th rib to 10th rib
Omasum	• Right side of body • Location: 7th to 10th rib of body
Abomasum	➤ Glandular part ➤ True stomach

- Right side of body & ventral to rumen
- Digestion completes here due to glandular secretions
- Location: lies above the xiphoid cartilage & goes upto 11th rib

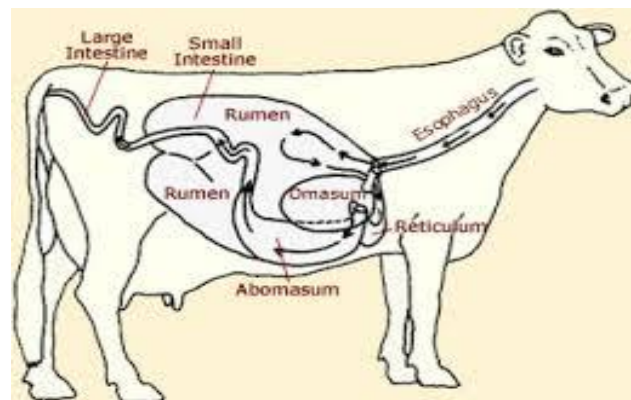
NOTE: At the time of calf birth, Abomasum is two times of the rumen, but after one year, rumen is 9 times bigger as compared to Abomasum.

Blood supply:

- Gastrophrenic artery (bigger)
 - Deep circumflex artery (smaller)
- Drain through vena cava.

Nerve supply/innervations:

- ✓ Lumbar nerve (smaller)
- ✓ Vagus nerve: (larger)
 - In abdominal cavity it has two branches/innervations;
 - Dorsal vagus nerve
 - To rumen
 - Caudal part of reticulum
 - Ventral vagus nerve
 - Rest part of reticulum
 - Omasum
 - Abomasum

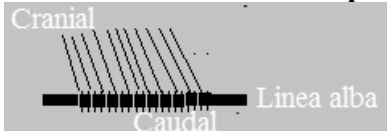


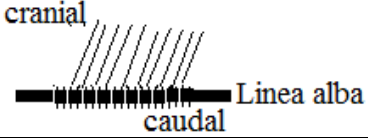
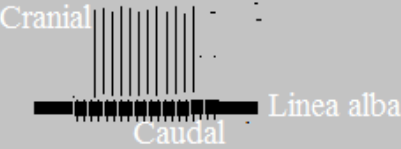
Abdominal wall:

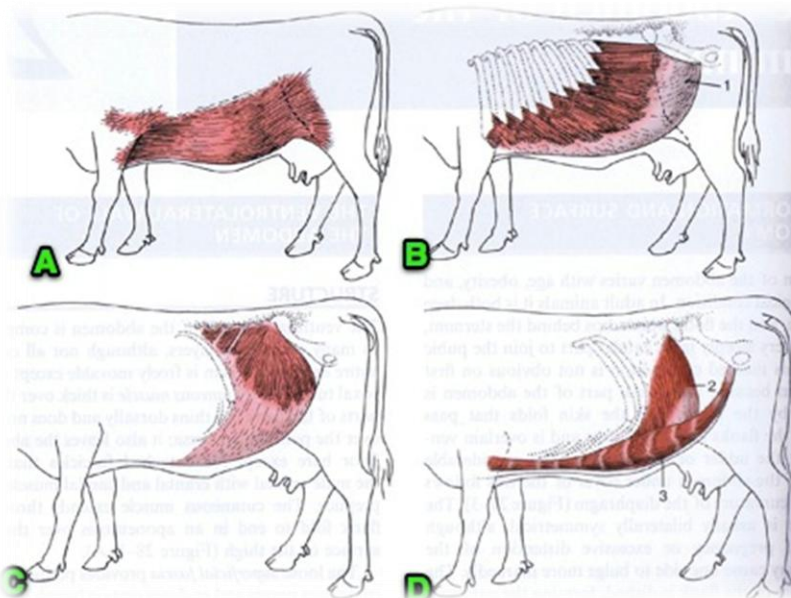
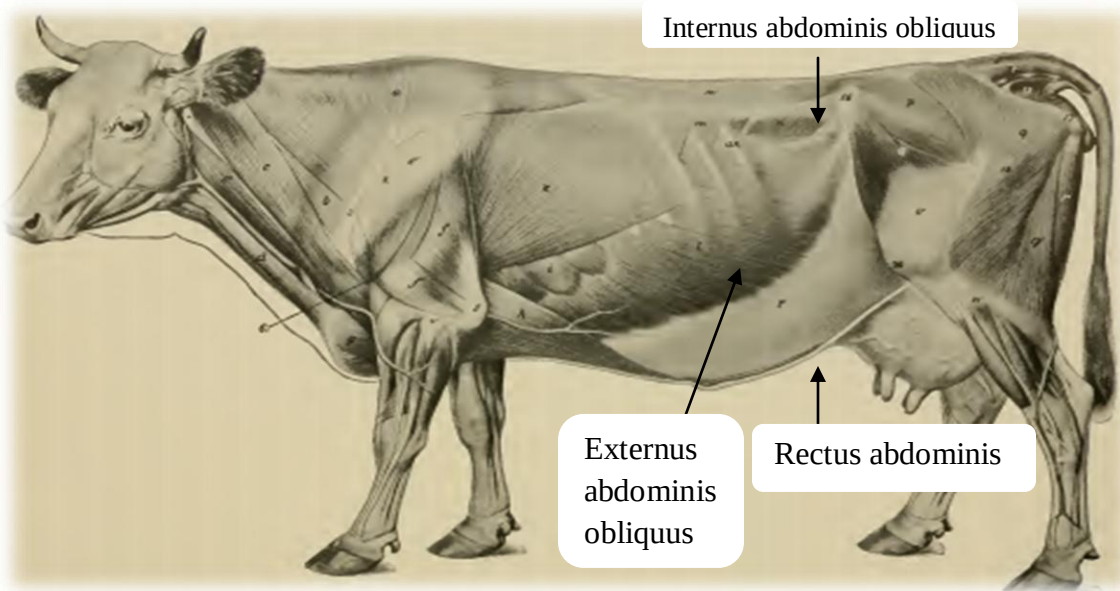
If go from outer side;

1. Skin
2. Four Muscles



Sr. #	Muscle	Features
1.	Rectus abdominis 	○ Complete muscle lies on ventral side ○ Strongest muscle of abdominal wall ○ Present on both sides of linea alba upto mammary vein ○ Its fibers run caudally ○ Origin: from 4th-9th intercostals cartilage upto Prepubic region on ventral side
2.	Externus abdominis obliquus 	✓ Lies on lateral side ✓ Present on all sides of linea alba & both left & right sides of abdomen ✓ Its fibers run caudoventrally

3.	Internus abdominis obliquus 	○ Lies on lateral side ○ Present on all sides of linea alba & both left & right sides of abdomen ○ Its fibers run cranioventrally
4.	Transverse abdominis 	✓ Lies on lateral side ✓ Present on all sides of linea alba & both left & right sides of abdomen ✓ Its fibers run vertically



A: cutaneous trunk line m.
 - loosely arranged through fat tissue
 - thicker in ruminant and horses
 - can 'flick' to get flies off

B: external oblique m.

C: internal oblique m.

D: transverse abdominis m.
 and rectus abdominis m.

Indications:

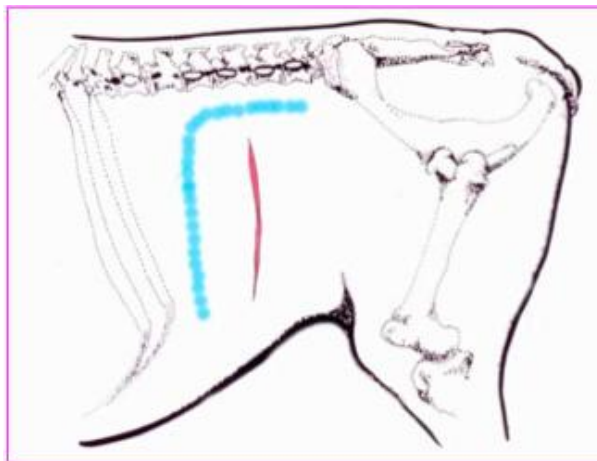
- ✓ Presence of foreign body (mostly)
 - Nails, wires, spoon, polythene bags, balls etc. (mostly in buffalo)
 - Trichobezoar (Tricho means hair, Bezoar means stuck) due to licking of hairs → hair ball formation (mostly in cows)
- ✓ Rumen stasis
 - Because normal rumen waves are 3-5 waves/mint
- ✓ Research purposes
 - Rumen fistula

Approach:

Standing animal's left side flank region

Anesthesia:

Inverted L-block infiltration is given dorsal Paravertebral on left side



- ✓ Local anesthetic agent i.e 2% Lignocaine, 2% Lidocaine, 2% bupivacaine infiltrated under the skin while 4% is for tropical use (absorbed by the skin & goes below the skin).
- ✓ Lignocaine + adrenaline cause vasoconstriction. This combination is used where there is more vasculature as it causes vasoconstriction but doesn't stop the heart pumping.
- ✓ It is not recommended to administer local anesthesia other than Lignocaine I/V because required results are not met or negative results may be seen.

Incision:

- ✓ Incision length should be 20-25cm, starting from 8-12cm below the transverse process of lumbar vertebrae and 4-6cm behind the last rib

- ✓ Incision length does not matter according to healing process because healing will be similar in all areas, rather to prevent contamination incision length should be minimum

Dellman, a histologist, said that, holding capacity of abdominal muscles decreases as we go towards the lumbar vertebrae.. **That's why 8-12cm below incision is made.** If there is any chance of contamination, there will be chances of osteomyelitis. **That's why 4-6cm behind the last rib.**

Procedure:

- Aseptic preparation of site
- Give separate incision to three muscles (Externus, Internus, Transverse) present on lateral side
- Cut the off-white color peritoneal membrane & 1st organ will be rumen
- Before giving incision to rumen wall, provide stay suture to the rumen wall at four sites with non-absorbable suture material to avoid spread of contamination of rumen contents into abdominal cavity.
- Give incision on rumen wall after fixing the wall of rumen
- Incision can be extended if needed but extend it towards the ventral side.
- Perform the surgery & close it but before closing, lavage the rumen wall & abdominal cavity with normal saline or 0.9% NaCl or Luke warm water.

Closure/Suturing:

2. Suturing of rumenal wall:

- Two layer suture pattern
 - i. 1st layer should be inverted
 - ii. 2nd layer should be Everted
- Continuous pattern
- Absorbable suture material having absorption time of 60 days should be used & size#2 (#1 in small animals) i.e Catgut Type-C.
- Mono-filamentous suture material should be used

3. Removal of stay suture: from abdominal wall & apply topical antimicrobial i.e pink spray, oxykort (oxytetracycline), CTC-spray (chloramphenicol). It is applied on incision site on rumen.

4. Suturing of peritoneal membrane:

- Continuous pattern
- Absorbable suture material is used
- In large animals, great need of care
- In small animals, less need of care

5. Suturing of abdominal muscles:

- Layer to layer suturing is done

- Transverse abdominis
- Dusting of penicillin/streptomycin or pink spray
- Externus abdominis obliquus
- Dusting of penicillin/streptomycin or pink spray
- Internus abdominis obliquus
- Dusting of penicillin/streptomycin or pink spray
- Use absorbable suture material
- Simple Continuous pattern
- Absorption time; minimum 20 days
- Type-C catgut is used
- Dusting with penicillin & streptomycin

6. Skin suturing:

- Ford interlocking pattern but Interrupted pattern is preferred because tensile strength in buffalo is less than cow than horses (highest)
- Use non-absorbable suture material
- It is wise to close the ventral aspect of skin incision with two or three simple interrupted sutures. The possibility of incisional infection is obvious & drainage can be easily obtained by removing these ventral two to three sutures if necessary.

Tubing pattern (horizontal mattress) is used to provide support to sutures because suture is pierced inside the skin in this pattern

Complications:

- Swelling at incision site
- Discharge at incision site
- Osteomyelitis
- Stitch abscess
- Peritonitis (may lead to death)



Postoperative care:

- ✓ Antibiotics
- ✓ Fluid therapy, if needed
- ✓ Rumen transfaunation can be given to re-establish normal flora & stimulate rumen motility

Advice:

- ♣ 3-5 days: withdraw of fodder, Dextrose 50ml/Kg, I/V
- ♣ 5-7 days: semi-solid diet
- ♣ After 7 days: normal diet

Vagal Indigestion Syndrome (VIS)

Anatomy:

Vagus nerve starts from pharynx to abdomen and it is present on both sides of esophagus.

VIS:

Mainly occurs due to any mechanical damage to vagus nerve especially to its ventral trunk.

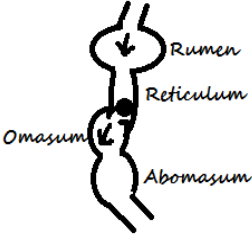
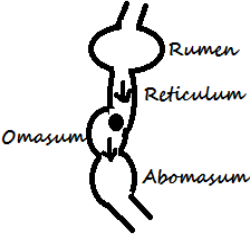
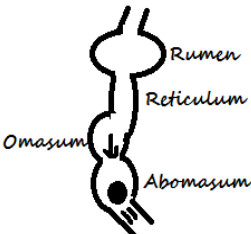
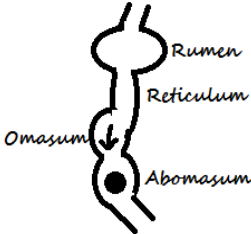
In Ruminants → Less digestion

In Monogastric → More digestion & Hypermotility

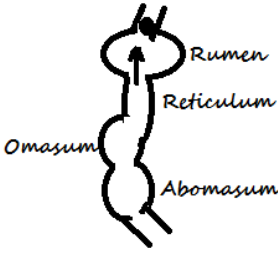
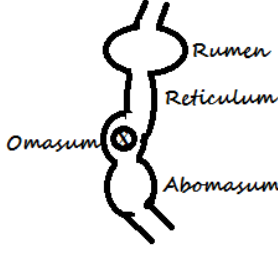
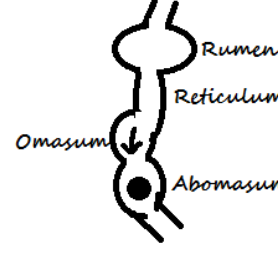
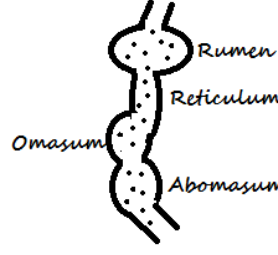
Etiology:

- ≡ Any **traumatic injury** due to direct trauma to vagus nerve
- ≡ **Pharyngeal inflammation**
- ≡ Abscess formation (Pharynx, cranial to rumen, Reticulo-peritonitis, Reticulo-pericarditis)
- ≡ Inflammation in thoracic cavity especially near to the passage of esophagus
- ≡ Mediastinitis (Inflammation of mediastinum) ((پھیپھڑوں کی درمیانی جھلی))

Classification: There are different classifications;

1- HOF LUND'S CLASSIFICATION OF VIS			
Type-I	Type-II	Type-III	Type-IV
It includes functional stenosis between reticulum & omasum	It includes functional stenosis between reiculum & omasum with normal or hypermotility of rumen	Permanent stenosis of Pylorus (pyloric end of abomasum)	Partial stenosis of pylorus
 Type-I	 Type-II	 Type-III	 Type-IV
IF BOCLKAGE/STENOSIS → Causes distension of rumen & reticulum			

2- FARRENITE AND WHITE LOCK'S CLASSIFICATION OF VIS

Type-I	Type-II	Type-III	Type-IV
Failure of eructation Stenosis of cardiac end	Omasal transport failure	Abomasal impaction Pyloric end	Partial obstruction of the stomach
			
Type-I	Type-II	Type-III	Type-IV

3- CORNELL'S CLASSIFICATION OF VIS

Type-I	Type-II	Type-III
Failure of eructation that leads to distension of abdominal cavity especially left paralumbar fossa	Failure of Omasal transport that will lead to distension of reticulum & rumen. Left paralumbar fossa & left ventral line	Stoppage of outflow from abomasum that will lead to distension of rumen, reticulum and abomasum Left paralumbar fossa, right & left ventral line

Clinical findings:

- ❖ If distension is present on both left & right paralumbar fossa, it clearly indicates VIS, not bloat.
- ❖ VIS is consequences of LAD (Left Abdominal Displacement), damage to vagus nerve because of it.
- ❖ Hypermotility
- ❖ More digestion in case of ruminants
- ❖ Some animals eat hair and they have formed hair-ball in any part of stomach or intestine, the hair-ball will stuck & called as Trichobazoar.
- ❖ Similarly ingestion of nails or polythene bags may lead to inflammation of vagus nerve
- ❖ Direct trauma
- ❖ Inflammation in thoracic cavity may affect vagus nerve

Signs of hypermotility:

- ✓ Distension of organs will be sooner
- ✓ Normal rumen waves = 2-3 waves in 2 mint

Treatment:i. Medicinal Treatment:

- **Phenyl butazone**
 - 0.5-0.7mg/Kg
 - B.i.d for 5-7 days
 - It is an NSAID but it has great effect on smooth muscles & tendons
 - Both in ruminants or Monogastric animals
- **Nerve tonic** but we can also perform **neurectomy of vagus nerve** because pyloric nerve will replace it.

ii. Surgical Treatment:

Three surgical approaches are recommended depending upon the type of VIS;

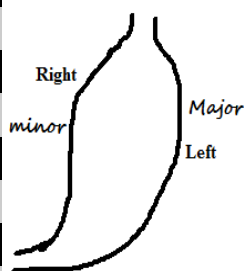
- i. If Type-I ➔ Rumenotomy / Trocar, Cannula
- ii. If Type-II ➔ Opening of reticulum by left ventral midline or paramedian approach
- iii. If Type-III or due to LAD ➔ Opening of reticulum by right ventral midline or paramedian approach

Equine Gastro-Enterology

Anatomy of Equines GIT:

Capacity of Ruminants

i. Stomach

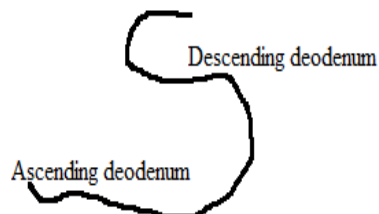


- ✓ Lies at T₁₃-T₁₄
- ✓ It has two surfaces
 - **Parietal**
 - Faces the liver
 - **Visceral**
 - Opposite to the parietal
- ✓ It has two curvatures
 - **Major/greater**
 - At visceral surface starting from cardiac to pyloric end
 - Lies at left & ventrally
 - In equines, there is presence of “**Saccus caecus**” at greater curvature that increases the capacity
 - **Minor/lesser/smaller**
 - From cardiac to pyloric end
 - Lies at right & dorsally
- ✓ Suspension is through different **ligaments**
 - From esophageal hiatus, **gastrophrenic ligament** originates & makes double layer around esophageal end and it ends at cardiac end. Then it splits into ligaments that hold the stomach;
 - **Phrenicolienale**
 - ≡ Holds the greater curvature & inserts on “**Saccus caecus**”
 - **Gastrolienale**
 - ≡ This holds the lesser curvature
- ✓ Then after pyloric end, mesentery is found around the lesser curvature which protects the blood vessels. This mesentery is also called large omentum. Mesentery is also present all around the small intestine
- ✓ **Blood supply:** directly from aorta.

	Cattle/Buffalo	Sheep/Goat
Rumen	102-108L	13-23L
Reticulum	2-3L Smallest	1-2L
Omasum	7-8L	0.2-0.5L Smallest
Abomasum	10-20L	1.75-3.3L

ii. Small Intestine

- ✓ It has three parts; but size varies depending upon the size of animal
 - **Duodenum (1-3m)** (Ascending & Descending duodenum)
 - “S” shaped, made from pyloric end
 - Descending is the shorter part & lies mostly at 3rd to 4th lumbar vertebra



▪ Jejunum (25-28m)

Orally: Peristaltic

Aborally: Anti-peristaltic

- Largest part of small intestine
- Its passage is mostly on right side → 70% & rest of 30% on left.
- **Antiperistaltic movement/segmental movement is by jejunum only for proper mixing of ingesta while peristaltic through GIT**

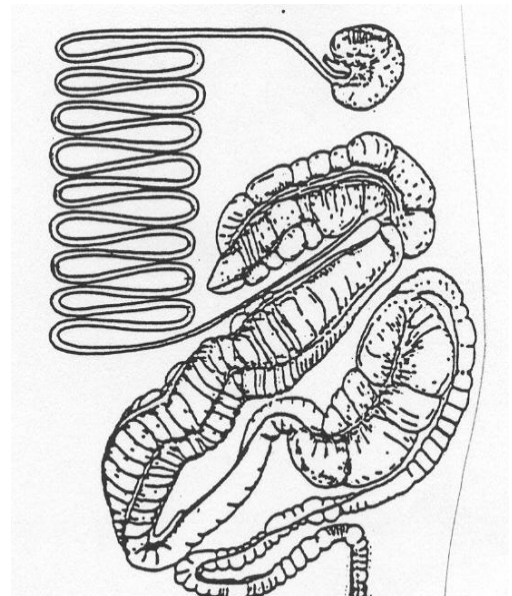
▪ Ileum (0.7-1.5m)

- Smallest part of small intestine
- Its lumen is narrower than other parts of small intestine
- It solely lies on left side

iii. Large Intestine:

✓ Caecum:

- At the junction of ileum & colon
- Two Caecum are present i.e 1m long with 33L capacity
- It has two parts;
 - Head
 - It is attached at the junction of Ileum & its lumen becomes shorter as it reaches the apex
 - Anatomically it is called “Caput caeci”
 - Apex
- It is located in pelvis; L₆-S₁
- Sometimes it touches the liver especially when it is extended during tympany
- Both caeca lie on the right side
- It has two curvatures;
 - Major/greater
 - Minor/lesser
- Four bands/tenia are present;
 - Tenia dorsal
 - Tenia ventral
 - Tenia caudal
 - Tenia cranial
- Two ligaments are present;
 - Ileocaecal ligament
 - Cecocolic ligament



✓ Colon

- It has two parts;
 - Small
 - Small due to small lumen as it starts from Caecum end.
 - Also called Descending
 - Large → also called Ascending
- Length: 3-4m
- Capacity: 38-60L

- ✓ **Rectum**

- Length: 20-30cm
- Terminal part of intestines

- iv. **Anus**

- ✓ Terminal or exit point of GIT
- ✓ Cave shaped projection with two muscles
 - Internal anal sphincter (Involuntary)
 - external anal sphincter (Voluntary)

- v. **Accessory Structures:**

- ✓ **Pancreas**
 - Lies in duodenal loop
- ✓ **Gall bladder**
 - Absent in equines
- ✓ **Liver**
 - Not well lobulated. It lies caudal to the diaphragm (both right & left)

Celiotomy

Opening of abdominal cavity from any place

*While **Leprotomy** is the opening of abdominal cavity from flank region only*

Approach:

- ✓ Horse is 17 ribs animal
- ✓ For example, C-Setion, approach for celiotomy

Approach	Ruminants	Equines
Paralumbar fossa	✓	X
Ventral midline	✓	✓
Para-median	✓	✓

Q. Why only Celiotomy or why paralumbar fossa approach is not possible in equines?

Ans. In equines the space between last rib & thigh, is very less so if we approach paralumbar fossa that won't be possible in equines so it is called Celiotomy only.

Note: in equines, ventral midline is preferred over para-median

Indications:

- ≡ Intestinal impaction
- ≡ Strangulation (torsion)
- ≡ C-section
- ≡ To make animal neutral (spaying)
- ≡ Herniation
- ≡ Intussusceptions

Intestinal impaction: average length of intestine is 35m so chances of impaction are there.

Colic is the No.1 killer of equines & intestinal impaction is the one of the causes of colic.

Anesthesia: General anesthesia according to dose rates

Recumbency: Dorsal recumbence

Pre-Op care: Clipping of hair from Xiphoid up to prepubis/prepuce → on both sides about 10-15cm

Procedure:

Linea alba: it is a strong point where all abdominal muscles unite & have strength to bear all the abdominal organs, its thickness in adult is 1cm which is reduced mass at 2cm of **umbilicus** & 3mm of **xiphoid**.

1) Incision:

- + 10-30cm incision depending upon if we diagnosed the impaction site

2) Location of umbilicus:

- + Recognize the **Linea alba**
- + Starting from incision, muscles of umbilicus
- + If we don't know the location of impaction, start from the 3mm of xiphoid up to prepuce. Then bluntly dissect the **falciform ligament**

3) Locate impaction site:

- + Mostly the impaction is at jejunum-Ileum junction.
- + The **Caecum** is landmark. Start palpation from pylorus then go towards L₃-L₅, jejunum is present there. Then colon is always on the caudal side of the head of Caecum.
- + Then identify the site & exteriorize the portion
- + If **Tympany**, exteriorize the Caecum/colon.
- + Needle: 14G 6 inches length
- + Insert needle parallel to serosa & muscularis. It should be at least 1 inch to serosa & muscularis then we may enter it to lumen. (this is done to prevent leakage)
- + We can also put suture over Caecum for more prevention & then remove indication

4) Closure of intestines:

- + Then close the intestine
- + Double inverted layer is preferred in equines
- + Inner layer = everted
- + Outer layer = inverted

5) Closure of abdomen:

- + Close Linea alba with bite 1.2cm away from incisional length vertically
- + Simple continuous pattern in equines
- + But incision is of 30cm then we have to break it at least 3 times with synthetic absorbable strong suture material (Polyglactin-910, PDS, polyglycolic acid) of size#3 in horse up to 600Kg body weight but if more than that then apply double.
- + Then S/C by applying the **Subcuticular pattern** of catgut of size#2

Prevention:

After 3-4 bites, tag the S/C fascia with rectus fascia so that dead space is not formed. Then apply polypropylene or Nylon on skin. Pattern will be simple interrupted horizontal mattress with tubes

to prevent stretching or piercing. Otherwise the suture/stitch sinus will be there due to pressure. The bites get expanded & sometimes suture abscess also formed with this condition.

Post-Op care:

- ≡ Application of **abdominal binders** to minimize the pressure
- ≡ Aggressive Antibiotic Therapy
- ≡ Analgesics
- ≡ Anti-inflammatory (from 2nd day to 5-7 days)
- ≡ ASD
- ≡ Dextrose

First 3-5 days Dextrose → Liquid diet → 7-10 days → semi-solid diet (Anastomosis)

But liquid diet from day#1 (Enterotomy)

Enterotomy/Side-to-Side Anastomosis

Opening and then closing of intestine after removing the cause of surgery/pain

Causes:

- + Foreign body
- + Phytobazoar
- + Intussusceptions
- + Strangulation
- + Gas accumulation
- + Fecaliths
- + Enteroliths (Broader terms including fecaliths & phytobazoar)

Anesthesia: General anesthesia

Recumbency: Lateral or Dorsal

Approach: *Linea alba* from dorsal Recumbency or from paralumbar fossa

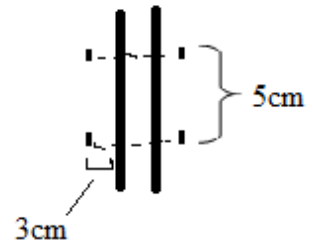
Procedure: It depends upon;

- ❖ Enetrotomy for small intestine (Duodenum, Jejunum, Ileum)
- ❖ Enterotomy for large intestine (Caecum, Colon)
- + Prepare the site aseptically, we have to shave 12-15cm surrounding area from *Linea alba*
- + Incisional site depends upon part of intestine
 - Duodenum → Cranial ventral midline
 - Jejunum → Medial ventral midline
 - Ileum → Caudal ventral midline
- + After sterilizing the area, give an incision whose length depends on the situation. Use drapes during Enterotomy to prevent the contamination or surgical site. Impervious drapes are recommended.
- + Secure the abdominal cavity with gauzes. These can be sterilized towels which prevent the contamination to go inward.
- + After getting the area of intestine, keep in intestinal sterilized tray and take it away from incisional site.

Surgery of Jejunum

- ✓ Jejunum has both peristaltic & anti-peristaltic movements

- ✓ Mostly strangulations & intussusceptions → twisting occurs in jejunum due to more length (25-28m)
- ✓ **Approach:** Medial ventral midline
- ✓ **Procedure:**
 - Use drapes & gauzes. Surgery of affected part is performed in case of impaction at jejunum (strangulation in jejunum is 99.9% due to impaction)
 - Incision is given aboral to the impaction site. Incision should be anti-mesenteric
 - Approach & remove the cause with the help of instruments or manually.
 - After removal of indication, lavage the area.
- ✓ **Closure:**
 - Polydioxanone (PDS), Polyglactin-910, Polyglycolic acid
 - In adults horses; #2/0 or catgut#3/0
 - Closure with two layers
 - 1st will be of simple continuous pattern
 - 2nd by Cushing over lambert
 - Distance from incision in first layer is 3cm
 - Distance between two bites on same side should be 5cm
 - Start beyond the incision and close up to behind the incision to prevent seepage/ check seepage. Close with lambert if seepage is there.
- ✓ **Closure of abdomen:**
 - Close Linea alba with bite 1.2cm away from incisional length vertically
 - Simple continuous pattern in equines
 - But incision is of 30cm then we have to break it at least 3 times with synthetic absorbable strong suture material (Polyglactin-910, PDS, polyglycolic acid) of size#3 in horse up to 600Kg body weight but if more than that then apply double.
 - Then S/C by applying the **Subcuticular pattern** of catgut of size#2



Surgery of Colon

- ✓ There are 4 limbs;
 - Right ventral/ascending colon
 - Left ventral/ascending colon
 - Right dorsal/descending colon
 - Left dorsal/descending colon
- ✓ Three flexors;
 - Sternal (right & left dorsal)
 - Pelvic (right & left ventral)
 - Diaphragmatic
- ✓ Mostly, the impaction is in ascending colon or pelvic flexor.

- ✓ **Diagnosis:** Rectal palpation
- ✓ **Recumbency:** Dorsal
- ✓ **Anesthesia:** Anesthesia
- ✓ **Approach:** Caudal ventral midline
- ✓ **Procedure:**
 - Drapes & gauzes are used.
 - After exteriorization, open impaction site with longitudinal incision otherwise suturing will be difficult due to longitudinal fibers. Remove impaction → lavage
- ✓ **Closure:**
 - Polydioxanone (PDS), Polyglactin-910, Polyglycolic acid
 - In adults horses; #2/0 or catgut#3/0
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 - Then S/C by applying the *Subcuticular pattern* of catgut of size#2

Post-Op care:

- ≡ Application of **abdominal binders** to minimize the pressure
- ≡ Aggressive Antibiotic Therapy (Quinolones, 3rd generation Cephalosporines etc.)
- ≡ Analgesics
- ≡ Anti-inflammatory (from 2nd day to 5-7 days)
- ≡ ASD
- ≡ Dextrose

Complications:

- ✚ Peritonitis
- ✚ Adhesions of intestinal site with other parts
- ✚ Mural abscesses forms at Enterotomy/Enterectomy site

Enterectomy/End-to-End Anastomosis

Anastomosis means to join two ends together.

Indications:

- ≡ Strangulation (most common)
 - Strangulation-Obstruction (strangulation due to abscess → mostly occurs in jejunum)
 - Torsion of intestinal mesentery which converts normal intestine to strangulation
- ≡ Intussusceptions
- ≡ Mesenteric lipoma
- ≡ Adhesions of intestine with other part
- ≡ Inguinal hernia (incarceration starts)
- ≡ Congenital abnormality of intestine leading to any pathological conditions which need to be removed

Principles of Anastomosis:

♣ Identification of area to be resected:

- Viable & non-viable tissue should be differentiated by:
 - i. Color of intestine
 - Normally reddish
 - If black, dark or white, it means they are gangrenous or necrosed
 - ii. Elasticity of intestine
 - If elasticity is lost → non-viable
 - iii. Arterial pulsation → feel pulse from artery
 - iv. Mesentery → if color is fade then it is non-viable. If it sticks to each other or any other organ then it means they are dreid.

♣ Decision for area of resection:

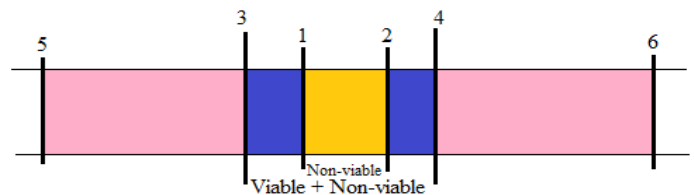
- We have to resect the non-viable area and some part of oral & aboral intestine to minimize the chances for further development of problem

♣ Asepsis

♣ Application of occlusion clamps

- Before applying the occlusion clamps, we have to remove/decompress the ingesta
- Six (6) clamps are used for large animals because of large lumen
 - 1 & 2 are applied on non-viable area/part
 - 3 & 4 are applied where viable part is also needed to be removed
 - 5 & 6 are applied away from the last two.

Resect area from 3 & 4 along with its mesentery then anastomose the area



♣ **Keep normal tissue wet which is outside the body**

- By using normal saline

Note:

- ✓ Never resect more than 40% of the total length
- ✓ Apply impervious drapes/gauzes etc.
- ✓ Extra part of intestine should be pushed back

♣ **Suturing:**

- In small animals, we apply simple interrupted but in large animals we have a problem of time & security so two layer pattern is applied,
 - Simple continuous
 - Mesenteric stay suture
 - Continuous lambert
 - Anti-mesenteric stay suture
- First opposition pattern is applied (simple continuous) starting from mesenteric toward anti-mesenteric (continuous lambert)
- **Two layered hand sew technique (Turpaie in local language)**
 - We can use a combination of everted & inverted for quick healing or both inverted for security of leakage/seepage
 - Mucosa & submucosa (sub-mucosa has more healing capacity)
 - Muscularis & serosa (muscularis has more healing capacity)

Post-Op care:

- ✚ Note temperature (extremely high or low temperature in septicemia)
- ✚ Observe animal
- ✚ Mural abscess
- ✚ Antibiotic therapy for at least 5 days
- ✚ Withdraw the food for 5-7 days
- ✚ Energy by fluid therapy
- ✚ Anti-inflammatory & pain killers

Caesarean Section

C-section is a surgical procedure to open the abdominal cavity for delivery of fetus. It is called Bada Operation in native language. Condition of embryo as well as of dam is of great concern in this. Posture, Presentation and Position should be defined before C-section.

History

1st successful C-section in human was performed in 1738 in Julius Caesar by the surgeon named Marry Dornally who was actually a nurse. 1st unsuccessful C-section in animals was performed in rabbit in 1903 in Hungary. C-section in cattle was started after World War II.

Practitioner should know how to decide what to do? Either surgery or fetotomy;

It depends on;

- ≡ Embryo condition (dead or alive)
- ≡ Opening of cervix
- ≡ Presentation of fetus
- ≡ Restraining facilities
- ≡ Skill of surgeon

Indications

Maternal indications are:

- 👉 Physical immaturity
- 👉 Uterine torsion
- 👉 Pelvic bone malformation
- 👉 Pre-parturient hypoglycemia
- 👉 Swelling of vulva and cervix

Foetal indications are:

- 👉 Abnormal posture, presentation and position
- 👉 Monster fetus
- 👉 Mummified fetus
- 👉 Emphysematous fetus
- 👉 Schistosomal reflexes (one organ of fetus is enlarged and thus is unable to pass out)

Cattle & Mare Approaches

Position	Cattle	Mare
Standing Position	1) Paralumbar fossa 2) Oblique Both approaches can be	Paralumbar fossa approach is not done because paralumbar fossa is narrow due to more

	performed either on right or left side of animal	ribs, so that oblique approach may be performed
Recumbence Position	1) Ventrolateral/Paramedian 2) Ventral midline 3) Paralumbar fossa	1) Ventrolateral/Paramedian 2) Ventral midline Paralumbar fossa approach is not done in mare

Left side approach in cattle is preferred over right side approach because about 20m intestine is extremely difficult to handle if come out of incision while rumen can be made aside to approach uterus. Left and right side approach is same in mare.

Sr.#	Approach	Details
1.	Standing Paralumbar Fossa Approach	This approach requires minimum use of manpower.
2.	Recumbent Paralumbar Fossa Approach	This approach requires extra manpower for restraining and casting of animal and especially to handle the intestine that abruptly comes out due to pressure if animal is approached from right side. Major disadvantage of this approach is difficult suturing of muscles due to organs' pressure. Three muscles
3.	Standing Oblique Approach	This approach is used in case of monster fetus. The incision is given at 45°.
4.	Recumbent Ventral Midline Approach	This approach is best for small animals. It is not preferred in cattle because stitches will open due to organs' pressure. It is better in mare than cattle.
5.	Recumbent Ventrolateral/Paramedian Approach	This approach is safer in mare as compared to cattle. It is safest approach in mare but not used commonly. Recumbent ventral midline approach is used rather than recumbent paramedian approach because we have to deliver live fetus within 20 minutes otherwise fetus may die. Four muscles.

In 4th & 5th approach, absorbable & non-absorbable depending on the size of animal. If large animal, use Nylon & if small animal, use polyglactin-910. **Knots:** surgeon or Reinforced knot

Anesthesia:

General anesthesia along with local infiltration is administered. Inverted L-block (7-pattern)

General Guidelines for C-Section

- 1) Don't let the uterine fluid seep into the abdominal cavity to contaminate it. Contamination is of major concern during C-section.
- 2) We should exteriorize the body of uterus outside the body and then perform procedure
- 3) If anterior fetal presentation (head towards cervix), approach & then open the abdominal cavity, hold its metatarsal bones of the right limb and pull it out from there.
If posterior fetal presentation, locate the metacarpal bones to pull it out from there. Then make a wedge of it so that it couldn't slip away.

- 4) Take the fetus out by approaching/grasping apex of horn because it is easy to approach the apex and then metatarsal in either anterior or posterior presentation
- 5) While pulling, pull right or left both limbs which is easy to extract the fetus out of body.

Incision on uterus:

As a general principle:

- ✚ If metatarsal → Knee to foot
- ✚ If metacarpal → Elbow/hock to foot

Generally, we can pull out whole fetus from this incision but if bigger size of fetus, we can expand the incision

Closure:

If everything has been normal without tearing then a single inverted layer will be enough with mono-filamentous suture material with tapered needle. Healing will be delayed with synthetic suture material and post-op complications increase. So, chromic catgut of large size is recommended. But if the uterus is fragile then double layer inverted pattern.

On sedation of cow, if Xylazine is used, it will cause contraction of uterus that will assure difficulty in closure so use alternate sedative.

Suture Pattern & Suture Material

Type D catgut is used in cattle while polyglactin-910 or polyglycolic acid is used in mare. Suture pattern is Cushing-over-Lambert with absorbable suture material. Suturing is done in 3 layers:

C-Section in Mare

<u>STAGES OF LABOR</u>		
1st Stage	2nd Stage	3rd Stage
Initiation of contraction etc. Passage of water bag 2-12 hr to 2-3 days	Delivery of foal. Very critical stage. Very short stage (20-40 mint). Decision should be made in this stage because when this stage ends, fetus can remain alive for 30 mint. After the end of 2 nd stage propulsion.	Propulsion of fetus

<u>CAUSES OF DYSTOCIA</u>	
Maternal causes	Fetal causes
✚ Improper dilation of cervix	✚ Monster fetus
✚ Narrowing of cervix	✚ Hydrocephalus
✚ Uterine rupture	✚ Abnormal presentation

✚ Cervix stricture (narrowing) ✚ Physical immaturity of mare ✚ Abnormal pelvic bone confirmation	✚ Abnormal posture ✚ Arthrogryposis (joints of body are abnormal, flexion of multiple joints)
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TYPES OF SURGERIES	
Elective Surgery	Emergency Surgery
When already known before time of parturition. E.g • Rupturing of uterine artery • Gnotobiotic foals/calves ○ Such foals are produced which are resistant to a bacteria, for research purpose Lab test for electrolytes to check; If Na^+ is more, K^+ & Ca^+ is less= it means time is left for surgery	When realized it to be a case of dystocia Lab test for electrolytes to check; If Na^+ is more, K^+ & Ca^+ is less= it means time is left for surgery

C-section if elective surgery:

- ✚ Hospitalize the animal 6-7 days before due date
- ✚ Procedure is done during 1st stage. In this stage we will observe;
 - Perineal cervical relaxation
 - Udder filled with milk
- ✚ At the end of 1st stage, water bag passes
- ✚ **Anesthesia:** General anesthesia is mandatory in C-section of mare. Regional or local are optional but local is preferred due to time saving. But at start, begin with a lower dose e.g if dose of Xylazine is 1mg/Kg, use 0.8mg/Kg
- ✚ Surgery should be performed within 20 mint.
- ✚ **Approach:**
 - Paramedian or lower flank approach (mostly British)
 - Ventral midline (mostly American)
- ✚ **Recumbency:** Lateral (cannot be performed in standing position)
- ✚ **Incision:** 30-35cm long incision on ventral midline on skin on *Linea alba* & 10cm from umbilicus → caudal to animal
- ✚ We should know if the foal is in anterior or posterior presentation. If anterior then approach from rear limb, if posterior then approach from fore limb. Incision will be made from hock/knee joint to feet. This incision is extended to prevent uterine rupturing, before this put 2 stay sutures;
 - Apex → Feet
 - Uterine bag → knee/hock
- ✚ Incision between stay sutures. Stat sutures should be 2-3cm apart from incision.

- ✚ Ligate the umbilical placenta
- ✚ Take the foal to warm place, clean the allantoic fluid to start respiration
- ✚ Before cutting placenta, wait for 2-3 mint, pulse will be low which decreases the chances of hemorrhages. But if the anesthesia has reached the fetus, give O₂ recitation
- ✚ Then lavage the uterus with N.S. in 2-3 layers
- ✚ **Closure of uterus:**
 - On incisional edges of uterus, simple continuous pattern
 - Then Cushing over lambert to close the uterine horns
 - Suture material:
 - Absorbable synthetic (Polyglycolic acid, polyglactin-910)
 - Size: 1 or 2
- ✚ After taking foal, don't bother about the restriction of time
- ✚ 10-15L Normal Saline to lavage the abdominal contents & removed by suction pump
- ✚ Closure of abdominal cavity: same as aforementioned in bovines.

Post-Operative Care

- ☑ Inject oxytocin (40IU) I/M to expel placenta. Time of infusion will b more than 4 hour, slow infusion (2-3 hr or 4-6 hr). If there is no placenta expulsion within 6-8 hours then inject double dose of oxytocin (80IU) I/M.
- ☑ Give painkiller
 - Ketoprofen
 - Meloxicam
 - Flunixin @ 1.1-2.2mg/Kg (repeated after 8 hours to prevent peritonitis)
- ☑ Mineral oil → P.O 2-3 days to prevent straining, constipation & opening of suture
- ☑ Give broad spectrum antibiotics
 - 3rd and 4th generation of quinolones
 - 3rd and 4th generation of cephalosporins
- ☑ Antiseptic dressing (ASD) for 5-7 days
- ☑ Suture observation for complications
- ☑ Green fodder up to 10 days
- ☑ Walk of animal 2-3 times a day
- ☑ Fluid therapy depending on the blood loss in surgery
- ☑ Abdomen binders or cloth can also be ties on abdomen

Urinary System

Urinary Calculi/ Uroliths: (Bovines, especially males)

Surgical interventions include:

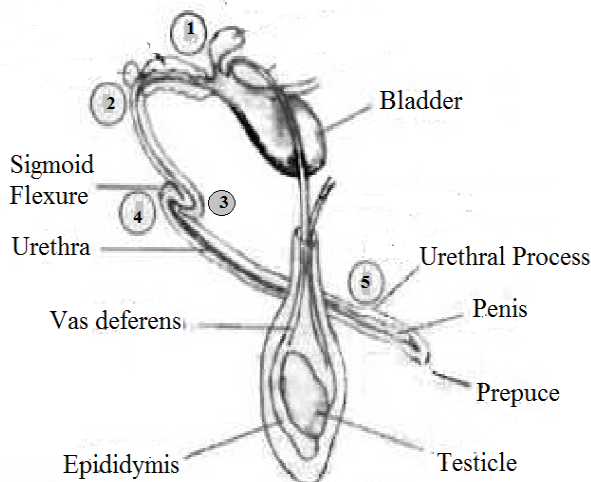
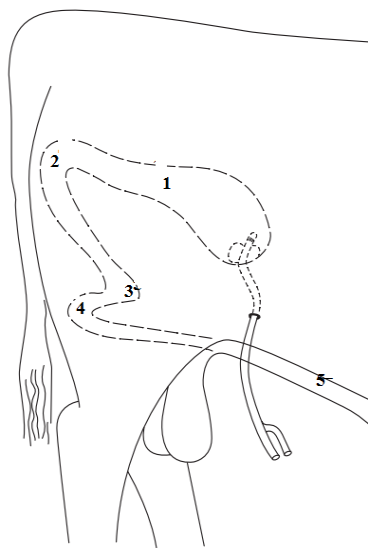
- + Cystotomy
- + Removal of calculus from urethra

In large animals; major concerns are for the removal of calculus. In equines, chances of obstruction are minimum due to straight passage. If there is obstruction, it can be removed by pushing it back into the bladder with the help of catheter. But in ruminants, especially in males, the situation is different.

- More carbohydrates in diet
- More proteins in diet

These both lead to calculi formation.

Most prevalent sites for calculi formation:



Common Sites for Calculi obstruction;

- 1- Neck of Bladder
- 2- Urethra at the Ischial arch of the pelvis
- 3- Sigmoid Flexure
- 4- Sigmoid Flexure
- 5- Urethral Process

Composition of calculi:

- ✓ Calcium phosphate (CaPO_4)
- ✓ Calcium oxalate (present in Cruciferous plants containing Saponins → Brassica plants)
- ✓ Calcite (Salt of CaCO_3)
- ✓ Silica (Salt of CaCO_3)
- ✓ Weddelite (CaC_2PO_4)

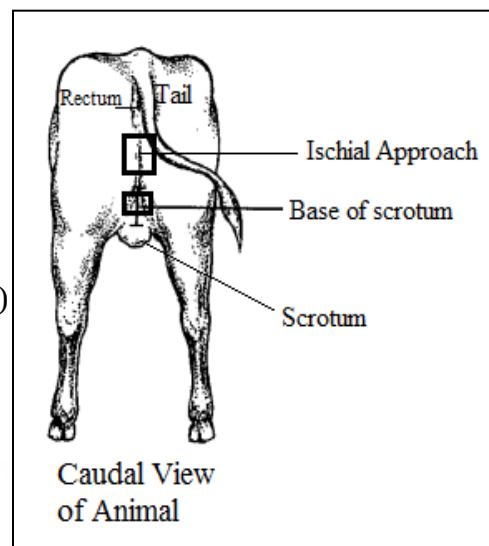
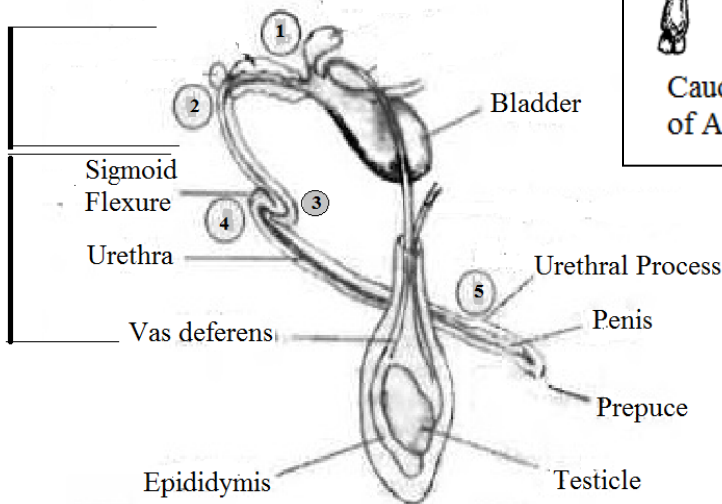
Diagnosis:

- History
- Rectal palpation of bladder → if urethra or bladder is involved
- Uric acid analysis (Urine analysis) → if rise in uric acid, it means bladder is full

Approach (Surgery):

From caudal side of animal;

- i. Ischial approach (In steer)
- ii. Base of scrotum (In steer)
- iii. Between scrotum & glans penis/prepuce (In breeding bull)

**Ischial Approach****Base of scrotum**

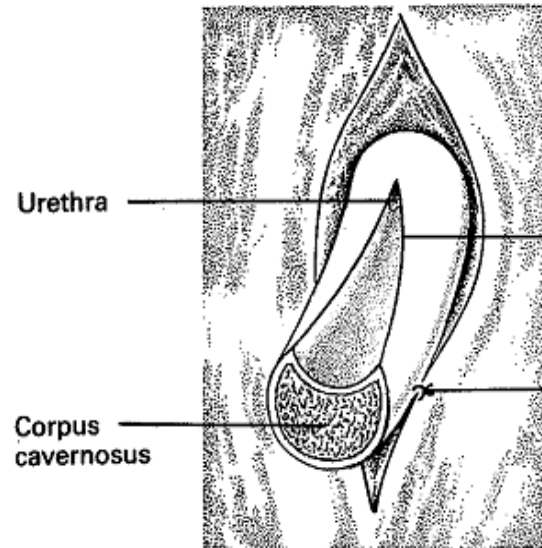
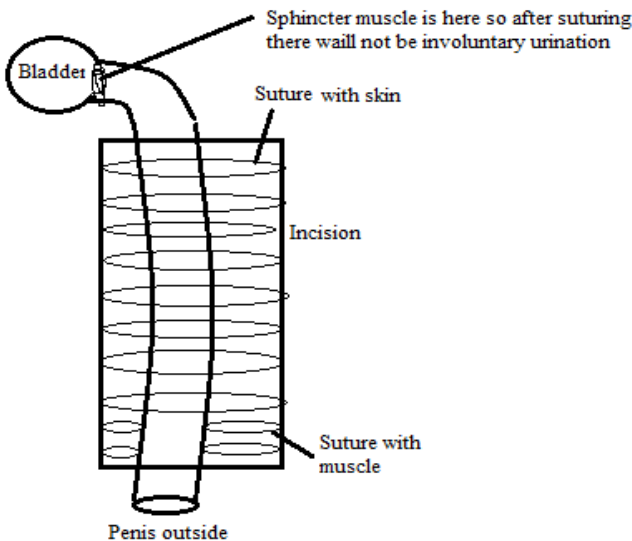
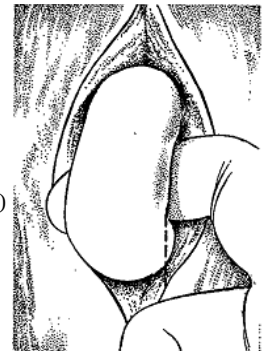
NOTE: *Ultrasound is the first step to be taken in case of any urinary problem & to give clean chit to urinary bladder, there is no problem then move ahead*

1- Ischial Approach:

- ✓ 5-6 cm incision will be given 5-6 inches below the rectum
- ✓ Undermining (remove the skin to observe muscles)
- ✓ Differentiate between penis & retractor muscle

Characteristics	Penis	Retractor Muscles
Visual appearance	Creamy	Reddish
Composition	Connective Tissues	Fibers (longitudinal)
Consistency	A little bit harder than muscle	Liver-like

- ✓ Pull the sigmoid flexure outward
- ✓ Check/observe the 2nd point (see the pic above) (for 1st point pass catheter)
- ✓ Sever/cut the penis
- ✓ Keep some part of penis out of body from incision after suturing (monofilament)
- ✓ Through this part urination will occur
- ✓ As this part of penis is touching the body so there will be urine-scars formation urine excretion directly on skin



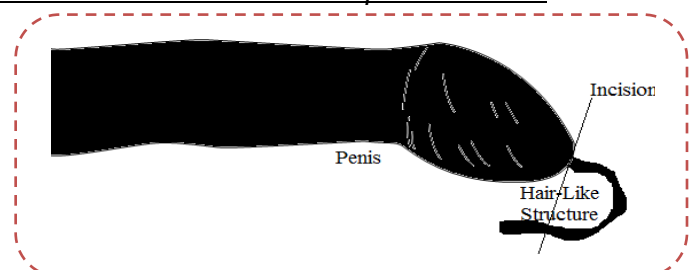
2- Base of scrotum:

- ✓ 5-6 cm incision will be given 1-2 inches above the base of scrotum, a little bit deep
- ✓ More Undermining because fat deposition is more here
- ✓ Differentiate between penis & retractor muscle
- ✓ Pull the sigmoid flexure outward from upper portion
- ✓ Check/observe the 3rd & 4th point (see the pic above) (for 2nd point pass catheter)
- ✓ Sever/cut the penis
- ✓ Keep some part of penis out of body from incision after suturing
- ✓ Through this part urination will occur
- ✓ As this part of penis is not touching the body so there will be no urin-scars

Anesthesia: Lumbo-sacral (Cranial epidural)

Lignocaine (1ml) + Xylazine (4ml) + Ketamine → in 400Kg adult animal

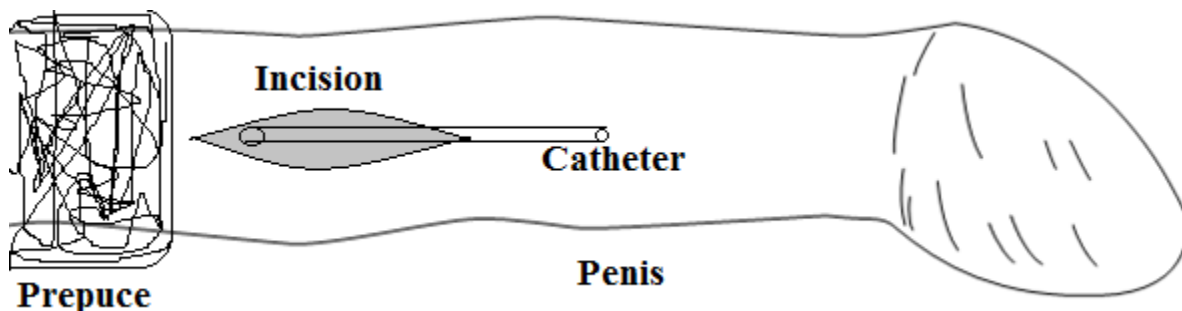
For penis' orifice opening in bull: *If the opening is closed by the hair like structure just near to urethral orifice then the cut is made between hair-like structure & urethral orifice to make it open.*



3- Between scrotum & prepuce:

This method is adopted when the pure bred bull is necessarily needed to be saved at any cost.

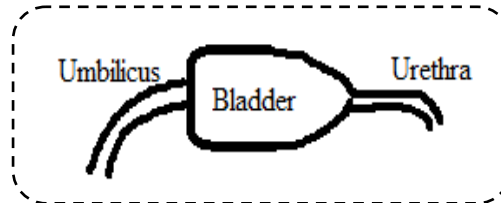
- ✓ For 5th point (in pic)
- ✓ Move the penis out of the prepuce
- ✓ Give incision on the penis
- ✓ Put catheter in urethra through that incision
- ✓ Suture it when catheter is still inside the urethra & remove the catheter when the suture is nearly to be closed
- ✓ Sutures:
 - Suture Pattern:
 - Three lines of sutures
 - All will be of continuous pattern (Everted)
 - Not inverted (it will provide pressure to urethra that will affect function)
 - First line of suture is to avoid urethral Stenosis because of small size of canal.
 - Suture material: (ophthalmic surgery sutures are used 4/0 to 7/0)
 - As there are Three lines of sutures
 - i. 4/0 polydioxanone (PDS)
 - Urethral canal's healing is delayed so this material has more absorption time (190 days)
 - If PDS is not available, catgut can be used in this first line
 - Vicryl can't be used here because it reacts with urine & forms calculi in canal
 - ii. 2/0 Vicryl
 - iii. 3/0 catgut
 - 2/0 silk = 3/0 catgut (can be used here)
 - 2 silk = 1 catgut



Urachus Pervichus/Pervious Urachus

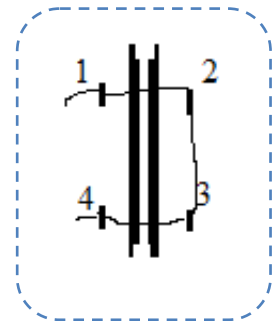
This condition is more in foals and calves. After birth, umbilicus is closed but if it doesn't close, then urine will drop out of it. When bladder is full & umbilical region will always remain moist. If it persists;

- ✚ Reterograde infection
- ✚ Abscess
- ✚ Peritonitis



Recommendation:

- ♣ **Carterization:**
 - Most recommended with 90% phenol
 - Do it after ligations of urachus
 - 1-1.5 inch towards the bladder
 - For 5-7 days
- ♣ After carterization, if it still persists, **Leprotomy**
 - 4-5 inch incision (2 inch cranial, 2 inch caudal)
 - Locate the urachus & make 2 ligations on the urachus
 - Close the *Linea alba* properly and apply **Mayo suture pattern** or **Vest over pant suture pattern**
 - Close the S/C suture pattern & continuous pattern on skin



Urethral Diverticulum:

It occurs mostly in kids. Just before prepuce, a natural opening is present in the urethra and a pouch is formed. There is an additional diverticulum with the natural passage. So the pouch is cut off. After sometimes, urethra heals by itself.

Urinary Bladder

Anatomy:

- ✚ **Shape:** pear like
- ✚ Free at neck, having a base called neck
- ✚ 2 ligaments on lateral side & 1 on ventral-mid side hold it with the body. These are round ligaments which are formerly the umbilical cord arteries
- ✚ Most ventral part lies in peritoneal region
- ✚ 2 interwoven layers of smooth muscles
 - **Inner layer:** circular in fashion
 - **Outer layer:** longitudinal in fashion. Except the cranial dorsal apex where it is circular

- ✚ Inner side is of transitional epithelium
 - It has the capacity to expand as the volume of urine increases
 - It cranially expands and comes on the ventral side of pubic bone (normally at prepubic)
- ✚ It is present on either side of midline

Conditions leading to surgical interventions:

- ≡ Cystorrhesis (rupturing of bladder)
- ≡ Cystic calculi (cystotomy is done)
- ≡ Everssion of bladder (mostly during prolapsed of females)
- ≡ Herniation of bladder (perineal hernia or ventral abdominal hernia)
- ≡ Persistent urachus
- ≡ Transitional cell carcinoma (neoplasm)

Cystorrhesis:

“Rupturing of bladder”

Condition that develops due to cytorrhexs includes; **Uroperitoneum** (it is very serious condition that needs an emergency treatment → emergency case)

Clinical signs:

- ✓ Depression
- ✓ Progressive anorexia
- ✓ Smell of urine from oral cavity
- ✓ Distension of abdominal cavity
- ✓ Dyspnea
- ✓ Dehydration

Diagnosis:

- ❖ History
- ❖ Clinical signs
- ❖ Diagnostic imaging
- ❖ Clinical pathological tests

Clinical Pathological testes:

- ♣ Measure creatinine from peritoneal fluid
- ♣ Serum creatinine
- ♣ Serum urea nitrogen
- ♣ Hyperkalemia in serum
- ♣ Hyponatremia in serum
- ♣ Hypochloremia in serum

Diagnostic imaging:

- ✚ Mainly made on the basis of abdominocentesis
 - Transparent or no color = Negative
 - Yellow or straw color & odorless = Positive
- ✚ Cystoscopy
- ✚ Ultrasonography
- ✚ X-rays

Observe creatinine in serum & peritoneal fluid: to confirm the peritoneal fluid creatinine is 2 folds the serum fluid normally

Treatment:

Before starting the surgical interventions, we have to stabilize the animal;

- ✚ Check if the animal is hyperkalemic;
 - Nervous signs, cardiac arrhythmia
- ✚ Check if the hyponatremia
 - Cardiac arrhythmia

So we have to stabilize the animal;

- ≡ Infuse 0.9% NaCl (if dehydration)----- OR 1.2% NaCl or 3% NaCl (if no dehydration)
When Na^+ will be more, K^+ will be less ($1\text{Na}^+ : 3\text{K}^+$). Chances of cardiac arrhythmia will be minimized
- ≡ Drain the peritoneum from ventral midline before the surgery to minimize the pressure of abdomen & Dyspnea will be relieved.

Surgery:

Anesthesia: General **Recumbency:** Dorsal **Approach:** Paralumbar fossa or ventral midline

Rupturing is mostly at the cranial apex because both layers are compressed by circular muscles.

- Locate the area of rupture
- Remove or correct the reason
- Washing with N.S. (Normal Saline)
- Suture it with two layers;
 - Cushing over lambert
 - Continuous then inverted lambert
- Washing of peritoneum with N.S.
- Simple continuous pattern with absorbable suture material on **muscles**
- S/C suture pattern on S/C layer
- If the approach was paramedian then suture muscles layer by layer

Urolithiasis:

- ♣ Formation of calculi in bladder
- ♣ Surgery performed is **Cystotomy**

Introduction:

Formation of calculi in bladder in equines is most commonly by hydration of CaCO_3 , which is soft, yellow green & having irregular shape. This is **Type-I urolithiasis**.

Type-II is the hydration of CaCO_3 with magnesium & phosphorus. These have hard, smooth & regular shape.

Urolithiasis is **more common in male horses than females** as male are more prone to it than females, because urethra of female is comparatively wider in diameter.

Clinical signs:

- ✓ Dysuria (difficult urination)
- ✓ Stranguria (slow & painful urination)
- ✓ Vocalization of animal while urinating
- ✓ Prolonged standing of animal, while posturing urination
- ✓ Hematuria (when type-I is stuck, they have irregular shape that causes bleeding)
- ✓ Dullness
- ✓ Depression
- ✓ Emaciation
- ✓ Mild colic

Diagnosis:

- ♣ History (especially of feeding) & previous history of calculi
- ♣ Physical examination
- ♣ Cystoscopy
- ♣ Observation of urination
- ♣ Observation of animal while urinating
- ♣ X-rays or contrast radiography

Treatment: (Cystotomy)

In adult bovines or equines, ventral midline in male & female and paramedian in male.

Anesthesia: General or local **Recumbency:** Dorsal

Approach:

- ≡ Ventral midline: Umbilicus to prepubis in females
- ≡ Ventral midline: Umbilicus to prepubis and then parallel to prepuce in males OR
paramedian in males simply.

Procedure:

- ✚ Incision length : 15-20cm
- ✚ Open and observe the bladder, identify the calculi and remove it
- ✚ Then perform 2-3 washings with N.S. and then suction

- ✚ Then pass catheter from bladder to urethra
 - In male/female equines: it will be passed up to prepuce & vagina
 - In female bovines: it will be passed up to vagina
 - In male bovines: Sigmoid flexure will not let it go further
- ✚ Closure of bladder
 - Two layered
 - Simple interrupted/continuous
 - Cushing (most important in equine)
 - Suture material should not go into lumen because urine of equines is alkaline leading to calculi formation. While in those, having acidic urine will lead to cutting of suture material
- ✚ Closure of abdomen
 - Mattress with simple continuous
- ✚ Closure of skin
 - S/C suture pattern

Post-Op Care:

- ❖ Observe urination
- ❖ Diet should not have more carbohydrates
- ❖ Antibiotic therapy
- ❖ ASD (Antiseptic dressing)
- ❖ Anti-inflammatory

Leakage in uroperitoneum:

- Rupturing etc.
- In equines, pass catheter through penis and infuse N.S. and fill the bladder & observe the leakage

Cystotomy is also performed in Neoplasia of:

- ≡ Transitional epithelium
- ≡ Squamous Cell Carcinoma (SCC)

Reproductive System of Male

Anatomy & Physiology of male reproductive system:

1. Scrotum:

“A pouch or diverticulum of abdomen at prepubic region having testes in it”

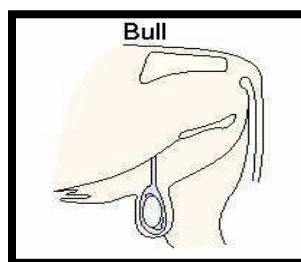
- ✓ It has a skin layer, *Tunica dartos* that controls temperature changes in environment, thermoregulation. This *Tunica dartos* imparts color on scrotum (red in bull & black in equines). *Tunica dartos* squeeze in cold temperature & expand in hot.
- ✓ It is having excessive sweat glands (more in equines) & Sebaceous glands (more in bovines).
 - **Sweat Glands:** Any of the glands in the skin that secrete perspiration
 - **Sebaceous Glands:** A cutaneous gland that secretes sebum (usually into a hair follicle) for lubricating hair and skin
- ✓ **Structure:**
 - Neck of scrotum in bovines → pedunculated & elongated
 - No neck of scrotum in equines → directly attached, round
 - Median raphe of scrotum/Scrotal Raphe:
 - Present between two testis, seen from outside
 - More prominent in bulls & having hair
 - Less prominent in equines
 - Rudimentary teat:
 - Present in bulls cranial to scrotum
 - Absent in equines cranial to scrotum

Equines (15-20cm)	Bovines (20-25cm)
Scrotum attached to prepubic region	Pedunculated scrotum with neck
More sweat glands	More sebaceous glands
Black color	Red color
Globular shape, cannot do burdizzo → no neck	Caudally compressed
Scarcely hair on scrotum	Small hair on scrotum
No rudimentary teat	Two rudimentary teats cranial to scrotum

Blood supply:

- Pudendal artery
- Pudendal vein

Nerve supply:



➤ Genitofemoral nerve

2. **Testicles:**

- ✓ Ductules (made-up of Rete testis, more than a dozen rete testis)
- ✓ Ductules combine to form seminiferous tubules (Adults; length of one S.F tubule= 70m)
- ✓ More than million of S.F tubules combine to form Epididymis

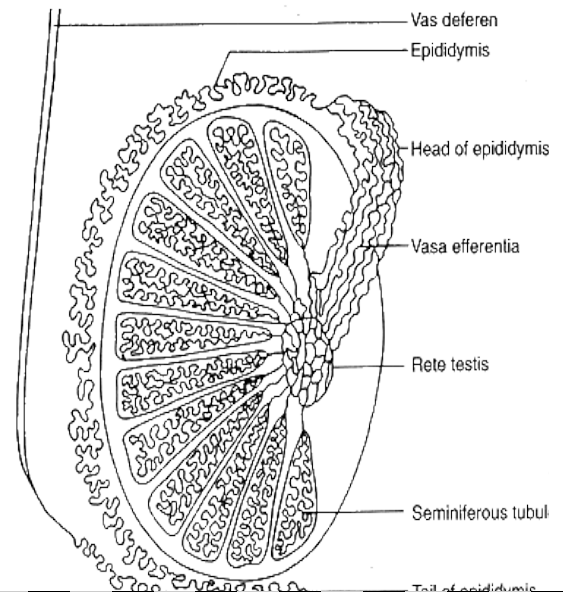
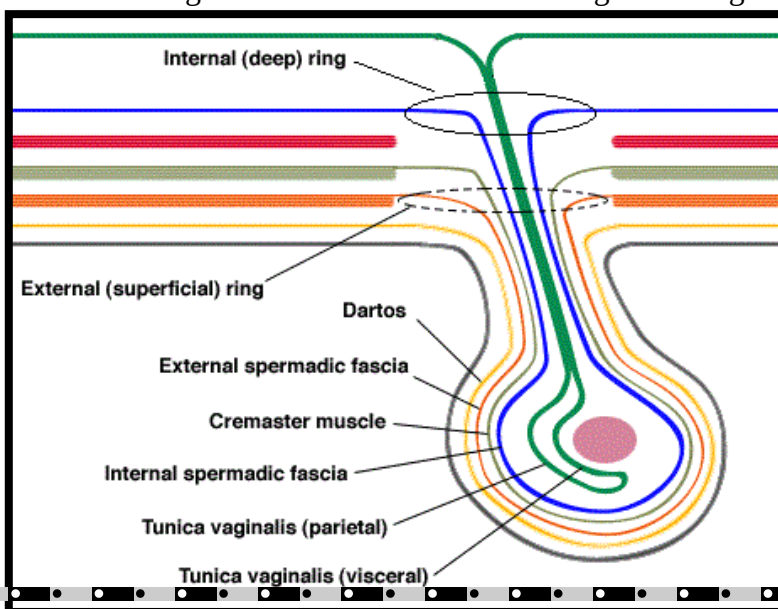
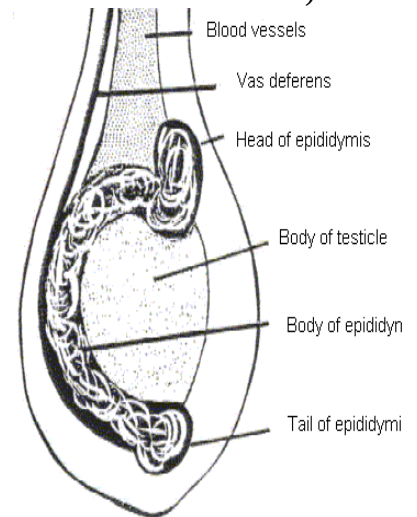
- Head of epididymis (Caput) (more S.F tubules)
- Body of epididymis (Corpus)
- Tail of epididymis (Cauda)

- ✓ Then ductus deferens starts (Cut in castration)
- ✓ Spermatogenesis occurs & sperms are transferred to urethra

✓ **Basic functions:**

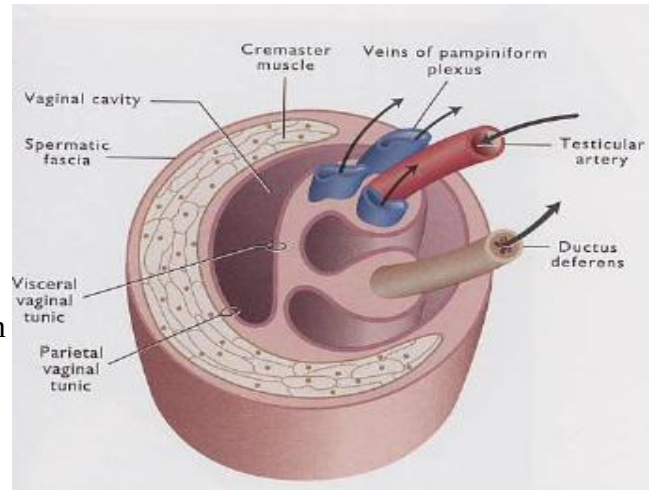
- Spermatogenesis
- Secretions of hormones
- Thermoregulation
- Storage of sperms

- ✓ Testis are covered with **Tunica Albugenia**, very fine, thin layer
- ✓ Tunica albugenia is covered with **Tunica Vaginalis**,
- ✓ **Tunica vaginalis** is composed of two layers; Tunica Fibrosa & Tunica serosa
- ✓ **Tunica Vaginalis** has two parts;
 - Parietal layer/Tunica vaginalis communis
 - Fat-like layer
 - More serosa, less fibrosa
 - Rough/irregular shape
 - Visceral layer/Tunica vaginalis propria
 - It is called T.V Propria because it covers the T. albugenia
 - Fine & thin layer
 - Less serosa, More fibrosa
 - Regular/specific shape
- ✓ Tunica vaginalis is derived from abdominal peritoneum that's slipped through inguinal ring into the scrotum to form a rough covering



3. Spermatic Cord:

- ✓ It is a slip of Internal Cremaster muscle or Internal Obliquus muscle
- ✓ Components;
 - Testicular artery → (originated directly from aorta) → supply blood
 - Testicular vein → drain blood
 - Testicular lymphatics
 - Testicular nerve
 - Tunical vaginalis
 - Ductus deferens
 - Internal cremaster muscle

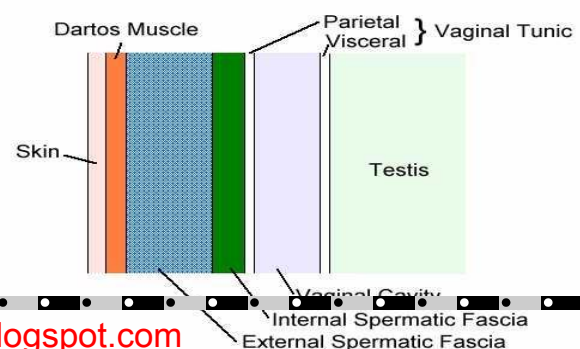


4. Inguinal Canal/Ring:

- ✓ Internal inguinal ring
 - Cranially bordered is attached with Internal Abdominus Obliquus
 - Laterally with Rectus abdominus along with prepubic tendon
 - Caudally with Inguinal Ligament
 - Oblique in nature with opening of 15-20cm in adults
- ✓ External inguinal ring
 - It is a slit of External Abdominus Obliquus muscle with opening of 10-12cm in adult horses & bulls (Slit is elliptical in nature)

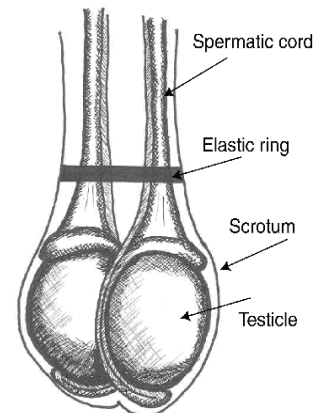
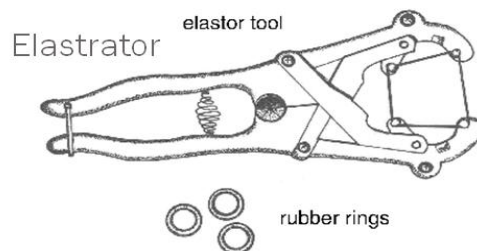
Indications:

- To make animal docile (to decrease libido) → Docility
- Meat quality enhancement
- Any pathological conditions
 - Tumors, myiasis, abscess, oedema, orchitis, epididymitis, hydrocoel (water accumulation between T. albuginea & T. vaginalis or T. albuginea & internal parenchyma) etc.
- Height
 - In bucks, in 4 to 6 months
 - In bulls & stallions, just after 2 year (24 months) within a short period, because long bone plates grow upto 2 year. Before 2 year, growth of long bones will be stopped that will affect the height so perform after 2 year.



Surgical Methods/Procedures/CASTRATION:

1. Mechanical
2. Chemical
3. Surgical



1- Mechanical Method:

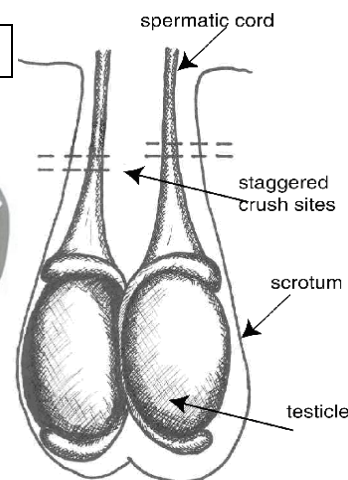
- ✓ Burdizzo castrator (Lignocaine will also be used)
- ✓ Rubber band/Elastic Band
- ✓ Stainless steel clips
- ✓ Emasculator



Mechanism: compress the spermatic cord/Nerve/ductus deferens/Seminiferous tubules etc.

2- Chemical Method:

- ❖ 70% parenchyma is composed of seminiferous tubules
- ❖ Irritating chemical is injected in parenchyma of testis
- ❖ That chemical will destroy the Seminiferous tubules
 - 4% carbolic acid (3-4ml)
 - 3-4% iodine solution (5-8ml)
 - 10% NaCl solution (5-10ml)
 - 7% copper sulphate
 - 10% $MgSO_4$
- ❖ Increased percentage will lead to complications
- ❖ Volume of solutions depends upon size of testis, chemical, age of animal



NOTE: Some people use progesterone (I/M), that may lower the libido but it is unethical because the body mechanism is disturbed. So don't do that in males.

3- Surgical Method:

- a. Orchidectomy/Orchiectomy: (surgical removal of one or both testicles) → complete
 - i. Open (spermatic cord is opened & separate ligations of parts of S. cord)
 - ii. Close (Spermatic cord is not opened, all parts are tied once)
- b. Vasectomy: (surgical removal of all or part of ductus deferens) → partial
- c. Epididymectomy: (surgical removal of all or part of epididymis) → partial

b & c → semen passage will be interrupted. 1-2cm part is excised. Flow of semen/sperm is ended. Desire will be there but animal will not be able to deliver (Teaser Bull). To prevent pregnancy in females/to detect heat signs in females

1: Orchidectomy/Orchiectomy:

Approach:

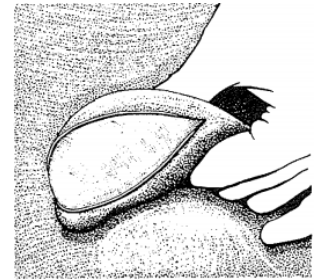
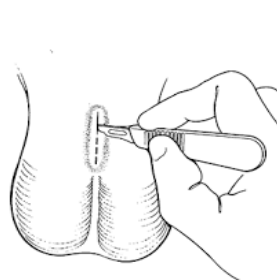
- ✓ If want to remove both testicles then incise the median raphe
- ✓ If want to remove one testicle then incise the scrotum from base of affected testicle

Anesthesia:

- General anesthesia in vicious animals
- Local anesthesia in calm & quiet animals

Close Method:

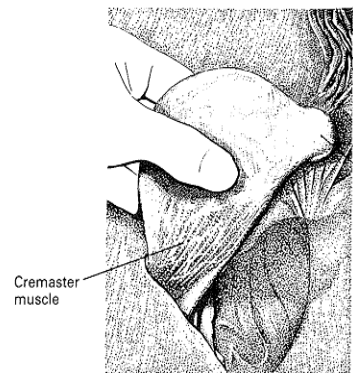
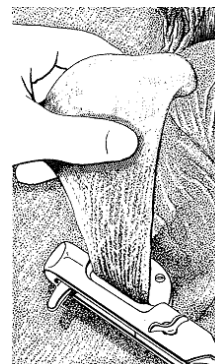
- i. Incise the median raphe grasping the testis
- ii. Skin of scrotum is opened without incising the Tunica Vaginalis
- iii. Pull out the affected testis
- iv. Use Ligations/haemostat/clamp on two positions above the target site & one below the target site. (this single ligation, below, may or may not be used)
- v. Between these ligations, excise the spermatic cord along with Tunica vaginalis & cremaster muscles. More chances of seepage/bleeding/Hemorrhages
- vi. Remove ligations to check stopped bleeding then remove haemostat



Emasculator can be used to aid ligations for 3-4 mint. Its principle is "FIRST CUT THEN CRUSH"

Open Method:

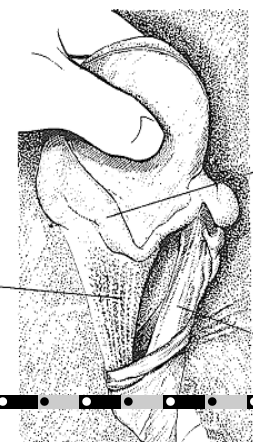
- i. Incise the median raphe
- ii. Skin of scrotum is opened
- iii. Pull out the affected testis
- iv. Tunica vaginalis visceral layer is also incised
- v. Testicle will come out
- vi. Six structures of spermatic cord will be seen
- vii. One ligation to testicular vein, 2nd to artery & 3rd to ductus deferens
- viii. Then cut these structures one by one
- ix. Remove the testicle (Less chances of bleeding/Hemorrhages. It is better than close)



Tail of epididymis
Attached portion

Tunica

Vascular part of spermatic cord

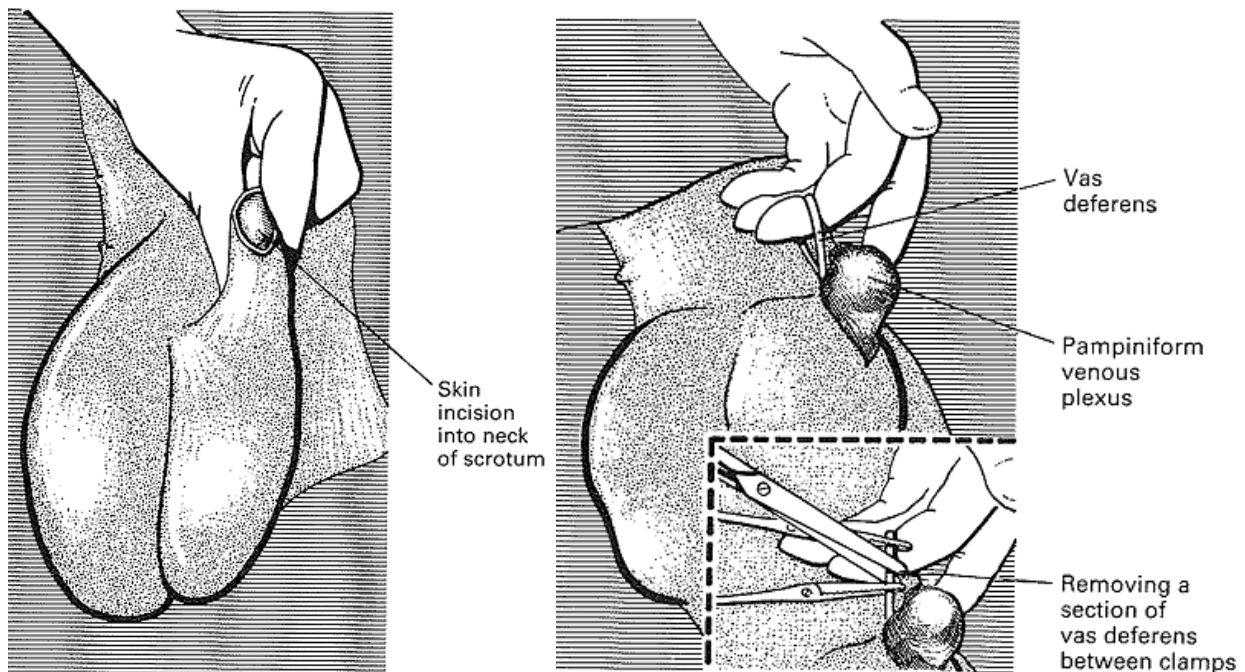


Epididymis

Non-vascular part of spermatic

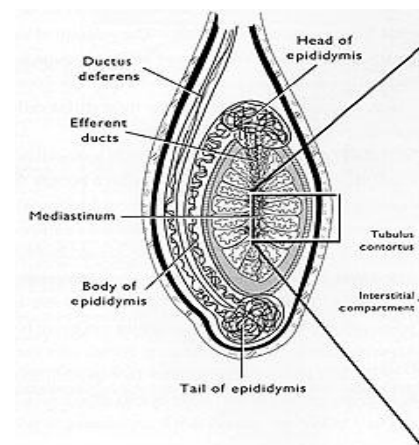
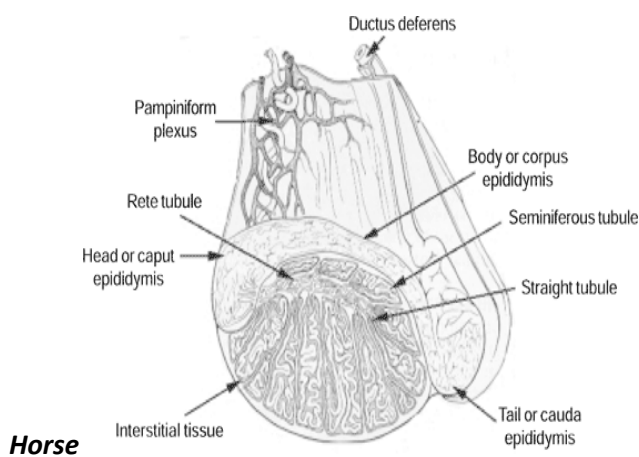
2: Vasectomy:

- i. Give incision in median raphe at the neck of scrotum
- ii. Then 3-5cm vertical incision on tunica vaginalis of spermatic cord
- iii. Six structures of spermatic cord will be seen
- iv. Identify the ductus deferens that will be creamy/off-white in color & firm/liver-like in consistency
- v. Pull it out
- vi. 1-2 cm piece of tunica vaginalis is pulled out
- vii. Make two ligations below & above the 1-2cm of target site
- viii. Cut this 1-2cm piece
- ix. Suture the tunica vaginalis with absorbable suture material & close every part upto skin



3: Epididymectomy:

- Epididymis runs Mediolaterally in bovines & Ventrolaterally in equines

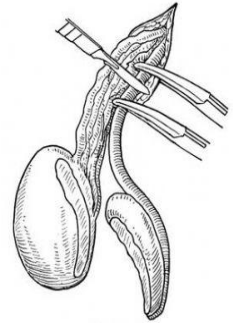


- i. Make 3-4 cm incision on vaginalis at median raphe in case of bovins & on lateral side in equines
- ii. Blunt dissection to the area where epididymis is located
- iii. Make one ligation above & one below the target site of 1-2cm of epididymis
- iv. Excise the target area (that area has many seminiferous tubules → path of sperms ended)
- v. Then suturing with absorbable suture material

NOTE: This method is used to make Teaser Bull.

Complications:

- Hemorrhages (due to improper ligations & dose method)
- Tetanus (in any castration use ATS or toxoid)
- Scirrhou cord
 - a chronic fibrous enlargement of the cut end of the spermatic **cord** in a castrated animal caused by bacterial infection (Tunica vaginalis)
- Evisceration (abdominal organs may be surgically removed accidentally)
- Champignon
 - Bacterial infection of stump of spermatic cord → streptococcosis
 - This word has been derived from a Mushroom, named “Champigna” because shape of distal end becomes just like mushroom
- Alter behavior (one reason is cryptorchidism → failure of one or both testes to move into the scrotum as the male fetus develops)
- Edema formation
 - Scrotum & prepuce
 - Up to 24 hour, movement of animal should be confined but after that normal exercise should be done to prevent edema formation



Post-Operative Care:

- ✓ Use of ATS or toxoid
- ✓ Wash with antiseptic solution
- ✓ Normal exercise after 24 hour (after 24 hr, otherwise ligations will open due to more BP)
- ✓ Antibiotic administration for 3 days
- ✓ Diuretics in case of oedematous swelling in scrotum & prepuce
- ✓ Aggressive antibiotic therapy in champignon & scirrhou cord

Reproductive System of Female

Anatomy:

We can split whole reproductive tract into two parts;

Cranial Reproductive Tract	Caudal Reproductive Tract
Body of uterus Uterine Horns Ovaries And its associated structures	Cervix Vagina Vestibules Vulva Perineum
	} External genitalia

Perineum:

- ✚ **Dorsal:** up to base of tail
- ✚ **Ventrally:** on ventral commissure of vulva
- ✚ **Laterally:** it is present with **Sacrosciatic ligament**
- ✚ **Muscles:** semi-membranous muscle (Buttock)
- ✚ Start from base of tail including anus
- ✚ Area between anus & vulvar region is composed of **Fibromuscular part**

Cranial:

- ❖ Ovaries are 70-80mm long & 40-60mm wide. This size could be variable regarding estrous cycle & season
- ❖ Kidney shape in mare
- ❖ These ovaries are hanged in abdominal cavity with the cranial part of broad ligament.

Blood supply:

- ♣ Up to vagina & cervix → *Vaginal artery*
- ♣ Body of uterus & ovaries → *Ovarian branch of Vaginal artery*
- ♣ Body of uterus → *Uterine branch of Vaginal artery*

Pneumovagina:

It means air in vagina. It is a condition of caudal reproductive tract that requires surgery. This is a vice in mare as well as some conditions may also develop → Infection & infertility occurs.

Indications:

- ✚ Poor body conditions
- ✚ Poor Perineal confirmation
- ✚ Weakness of external anal sphincter
- ✚ During foaling, any injury may cause pneumovagina
- ✚ Excessive contraction or stretching of vulvar lips (vice)

Treatment (Episioplasty):

It was first described in 1937 by “**Caslick**” and this procedure is also called “**Caslick procedure**”.

- ✚ **Principle:** To develop a scar over a vulvar lips
- ✚ **Anesthesia:** Local or cranial epidural anesthesia in vigorous animal
- ✚ **Standing animal**
- ✚ **Procedure:**
 - After securing the legs (single sideline or double sideline)
 - Infiltration of local anesthesia into the vulvar lips
 - **Incision:** incise the mucosal membrane 4-8mm with the help of scissors (mucocutaneous). Up to the ischial arch, lower part is left for urination
 - Seal of dorsal commissure should be proper
 - Simple continuous pattern with size#2/0 of absorbable or non-absorbable suture material

NOTE: If the animal is in estrus, reopen it. Breed animal and re-apply it. But sometimes, it may lead to **Pseudo-Pregnancy**

Ovariectomy:

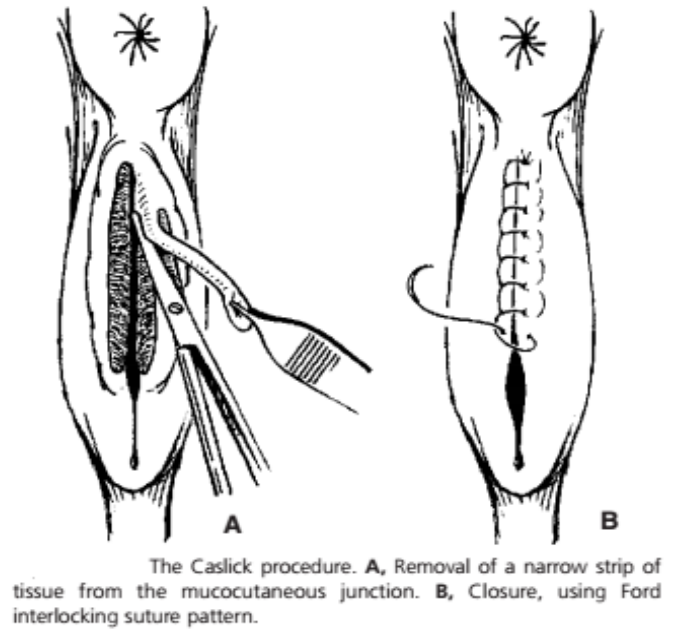
“Surgical removal of one or both ovaries”

Indications:

- ✚ Research purpose
- ✚ For health acquiring conditions in mare
- ✚ Racing mares

Procedures:

- i. Laprotomy
- ii. Colpotomy
- iii. Laparoscopy (A new procedure)

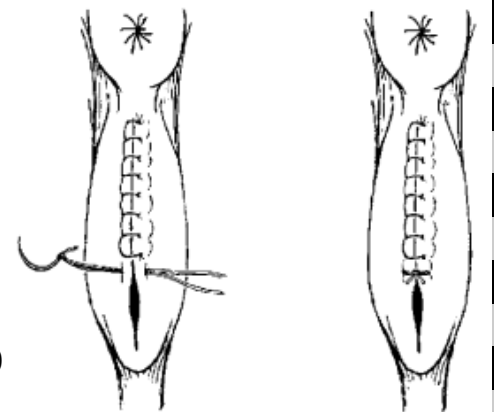


1. Laprotomy:

- **Approach** from left side due to more part of jejunum on the right side of the horse
- **Incise** the paralumbar fossa
- Locate the ovaries
- Exteriorize them
- Cut them

2. Colpotomy:

- ❖ **Approach** is through vagina
- ❖ **Anesthesia:** General anesthesia
- ❖ Animal is in stock position (sit on knee & hock joint)
- ❖ 4-5cm before cervix
- ❖ Open through speculum
 - For right-handed surgeons: 4-5cm from cervix in 2 or 4'O clock
 - For left-handed surgeons: 4-5cm from cervix in 8 or 10'O clock
- ❖ **Incision:** Incise vagina by a *bistoury* or *scalpel* (scalpel is actually not recommended). It will be just like stab or nick. Then blunt dissection with close ends of blunt scissors (like undermining)
- ❖ Then with the help of digits, open it so much as our fingers can pass.
- ❖ Approach ovaries: first right then left → for right hander
- ❖ Then Lidocaine soaked gauze is applied on the ovaries for 1-2 mint so it becomes desensitized.
- ❖ Then apply a chain loop of ecraseur



Left Handed

Right Handed

- ❖ Pass the chain surrounding fallopian tube. Tight it up by knob. Keep it here in tight position for 5-10 mint.
- ❖ It will crush and ovary will come out in our hand, same with the left ovary.
- ❖ Not there are two school of thoughts for incision on the vagina;
 - 2-3 sutures: for proper confirmation, non-absorbable suture material for quick healing
 - No suturing, open healing
- ❖ **Post-Op Care:**
 - For 2-3 days, keep the animal in standing position otherwise there will be evisceration.
- ❖ **Complications:**
 - **Hemorrhages:**
 - If broad ligament comes in chain, loose grip, crushing is not proper
 - **Evisceration:**
 - If the animal sits down

3. **Laproscopy:**

- ♣ 3 incisions are made on paralumbar fossa
 - i. For endoscope
 - ii. For instruments → ovarian exteriorization
 - iii. For hands → manipulations