

ANATOMY AND AFFECTION OF UDDER AND TEAT

Udder anatomy

The mammary gland is a modified sweat gland that nourishes the young. It consists of the **mamma** and the **teat**. Undeveloped in both the male and female at birth, the female mammary gland begins to develop as a secondary sex characteristic at puberty. With the birth of the first young, and first lactation, the mammary gland attains its full size and function. When suckling by the young stops, milk production ceases and the gland regresses. Shortly before the next and subsequent parturitions, the gland is stimulated by hormonal changes to produce milk.

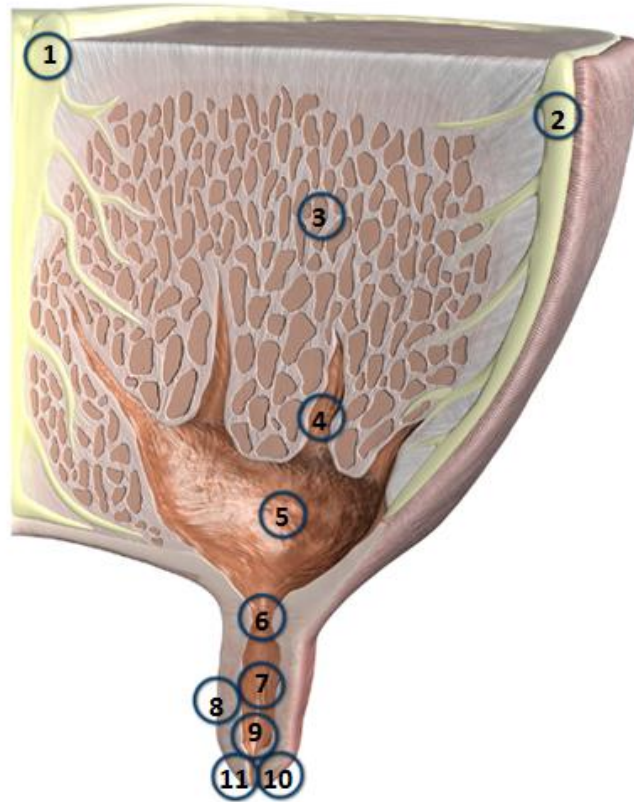
The udder of the cow and buffalo is composed of four quarters each of which is a separate unit and is considered as an independent compartment. Thus the affection of one quarter does not necessitate the involvement of the other quarters. In cow, the teats of the anterior quarters are more longer than the posterior. In buffaloes the anterior teats are more shorter than the posterior thus, the anterior teats of the cow and the posterior ones of buffaloes are more subjected to injuries. The udder in ewes and goat is composed of two halves, right and left.

The main parts of the udder are:

- **Median suspensory ligament:** Composed of two elastic layers of tissue, it attaches the udder to the cow's abdomen and separates the left and right halves of the udder.
- **Lateral suspensory ligaments:** Composed of fibrous tissue (non-elastic), provides support for the udder. These ligaments partially envelope the right and left halves of the udder and do not stretch as the gland fills with milk.

- **Parenchymal tissue:** Functional tissue involved in milk production, mainly composed of alveoli and ducts.
- **Interlobal ducts:** Primary ducts that drain milk from multiple lobes to the udder cistern.
- **Udder cistern:** Area located above the teat, at the base of the udder.
- **Teat cistern:** Middle part of the teat between the base of the udder and the Furstenberg's rosette.
- **Furstenberg's rosette:** Valve located between the teat cistern and the teat canal.
- **Muscular layer:** Composed of involuntary muscle fibres, allows the teat canal to open and close to release milk.
- **Mamma (pleural = mammae):** is the glandular structure associated with a **papilla** (teat) and may contain one or more duct systems.
- **Udder:** is a term designating all the mammae in the ruminant and the mare (sometimes also used for the sow).
- **Lobes:** are the internal compartments of the mamma, separated by adipose tissue. The lobes are divided into **lobules**, consisting of connective tissue containing **alveoli**, which are clusters of milk secreting cells.
- **Lactiferous ducts:** are large ducts conveying milk from the alveoli to the **lactiferous sinus**. The openings of the lactiferous ducts convey milk formed in the alveolus to the gland sinus.
- **Lactiferous sinus (milk sinus):** is the milk storage cavity within the teat and glandular body.
- **Gland sinus:** is part of the milk sinus within the glandular body and the **teat sinus** is part of the milk sinus within the teat.
- **Teat:** is the projecting part of the mammary gland containing part of the milk sinus.
- **Ostium (teat opening):** is the opening of the papillary duct and the exit point for milk or entrance point for bacteria.

- **Teat canal (Papillary duct):** Final part of the teat, connected to the exterior through the sphincter, leading from the teat sinus to the teat opening and may be single or multiple.
- **Teat sphincter:** tip of the teat where the teat canal opens to the exterior, Sphincter consists of muscular fibres surrounding the teat opening that prevent milk flow except during suckling or milking.

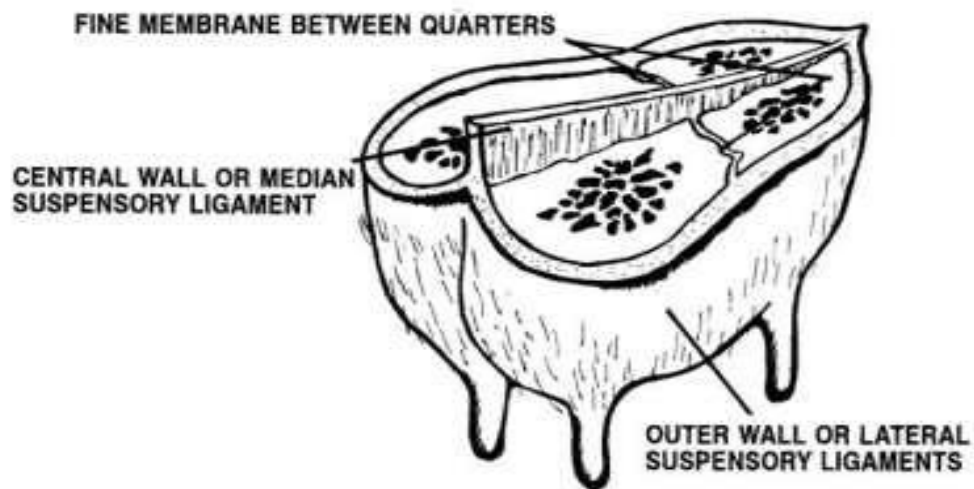


1- median suspensory ligament. 2- lateral suspensory ligament. 3- parenchymal tissue. 4- interlobar ducts. 5- udder cistern. 6- duct connecting udder cistern with the teat. 7- teat cistern. 8- muscular layer. 9- Furstenberg's rosette. 10- teat sphincter. 11- teat canal.

Suspensory System:

- Required to maintain proper attachments of the gland to the body.
- Skin gland: therefore external to the body cavity.

In species with large udders, especially in dairy cattle, there is a suspensory apparatus, which is organised into the lateral and medial laminae suspending the mammary gland from the ventral aspect of the trunk by their attachment to the pubic symphysis. The **lateral lamina** consists of collagen fibres from the fascia of the pubic symphysis and the edge of the superficial inguinal ring. The **medial lamina** consists of elastic fibres from the tunica flava ventral to the pubic symphysis. The **intermammary groove** divides the left and right rows of mammae.



Suspensory System consists of 7 Structures:

1. Skin.
2. Superficial fascia or areolar subcutaneous tissue.
3. Coarse areolar or cordlike tissue.
4. Subpelvic tendon.
5. Superficial layers of lateral suspensory ligament.
6. Deep lateral suspensory ligament.
7. Median Suspensory Ligament.

Minor supports:

1. **Skin** covering the gland is only of very minor support.
2. **Superficial fascia or areolar subcutaneous tissue:** this attaches the skin to underlying the tissue. It too is only of minor support for the cow's udder.

3. Coarse areolar or cordlike tissue:

- This tissue forms a loose bond between the dorsal surface of the front quarters and abdominal wall.
- Referred to as → the fore quarter attachments → dairy cattle conformation.
- **Function/Purpose:** Keep the fore quarters closely attached to the body wall.
- **Weakening** → the udder to break away from abdominal wall.

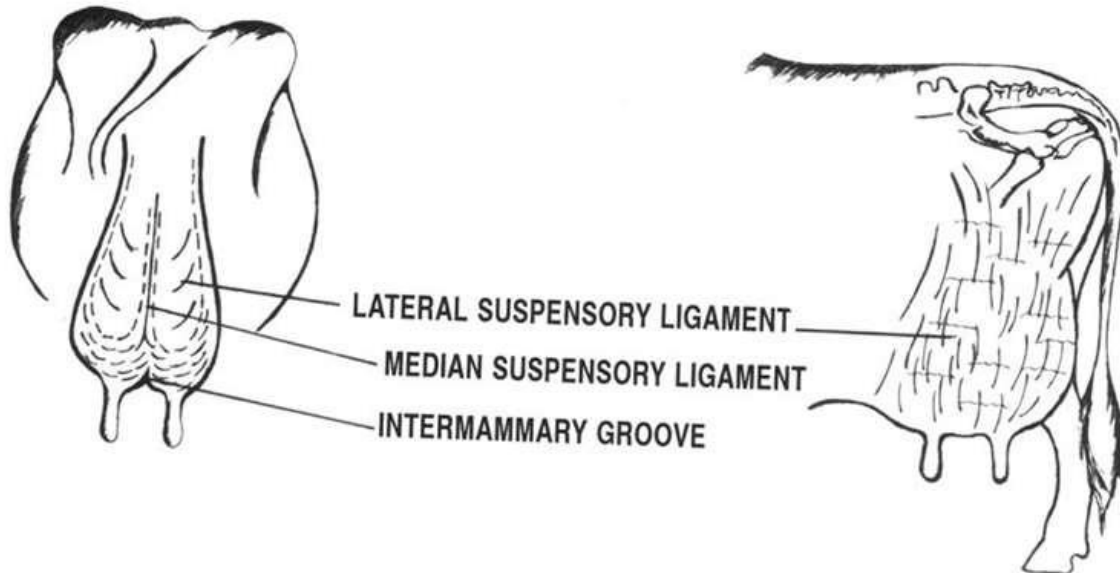
4. Subpelvic tendon:

- Not actually part of the suspensory apparatus, but gives rise to the superficial & deep lateral suspensory ligaments.
- It is not a continuous tissue sheet but is attached to the pelvis at several points.

5. Superficial layers of lateral suspensory ligament:

- Arises from the subpelvic tendon (fibrous tissue with some elastic tissue).

- They extend downward and forward from the pubic area. When it reaches the udder it spreads out, continuing downward over the external udder surface beneath the skin and attaching to the areolar tissue.



6. Deep lateral suspensory ligament:

- Arises from the subpelvic tendon, thicker than the superficial layer.
- fibrous tissue, they do not stretch as the gland fills with milk).
- It extends down over the udder and almost enveloping it.

The ligament attaches to the convex lateral surfaces of the udder by numerous **lamellae** (divide parenchyma into lobe and lobule).

- The left and right lateral suspensory ligaments do not join under the bottom of the udder.

7. Median Suspensory Ligament:

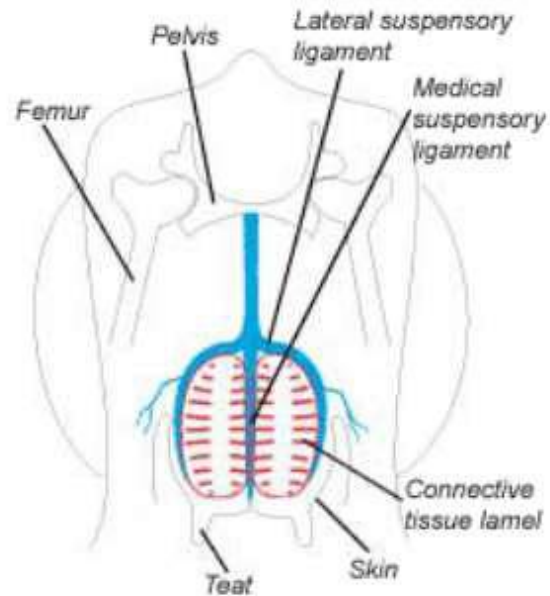
This is the most important part of the suspensory system in cattle.

Composition: two adjacent heavy yellow elastic sheets of tissue.

Origin: the abdominal wall.

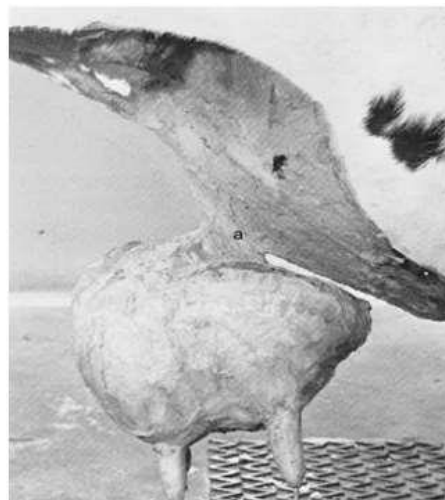
Insertion: medial flat surfaces of the two udder halves.

Location: the center of gravity of the udder.



The suspensory structure of the udder

Even if rest of the layers are cut away except for the median suspensory ligament, the gland stays balanced under the animal.



Properties

1. Great tensile strength.
2. Able to stretch somewhat (the gland fills with milk to allow for the increased weight of the gland).
3. Balanced suspension.
4. Partially separates the left and right halves of the udder.
5. Front and rear quarters are separated by a thin membrane and is not recognizable to the eye.
6. There is NO internal crossover of the milk duct system of the quarters (glands).

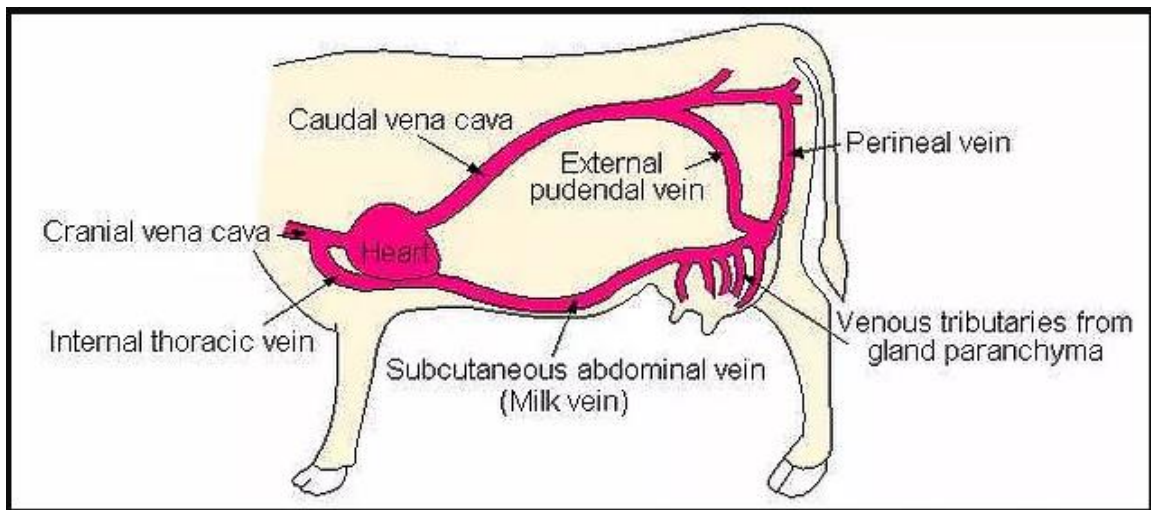
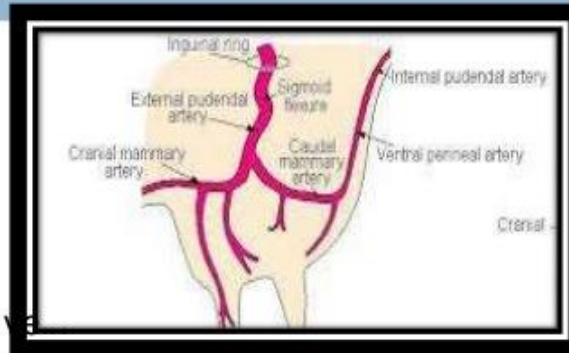
Blood supply of the udder

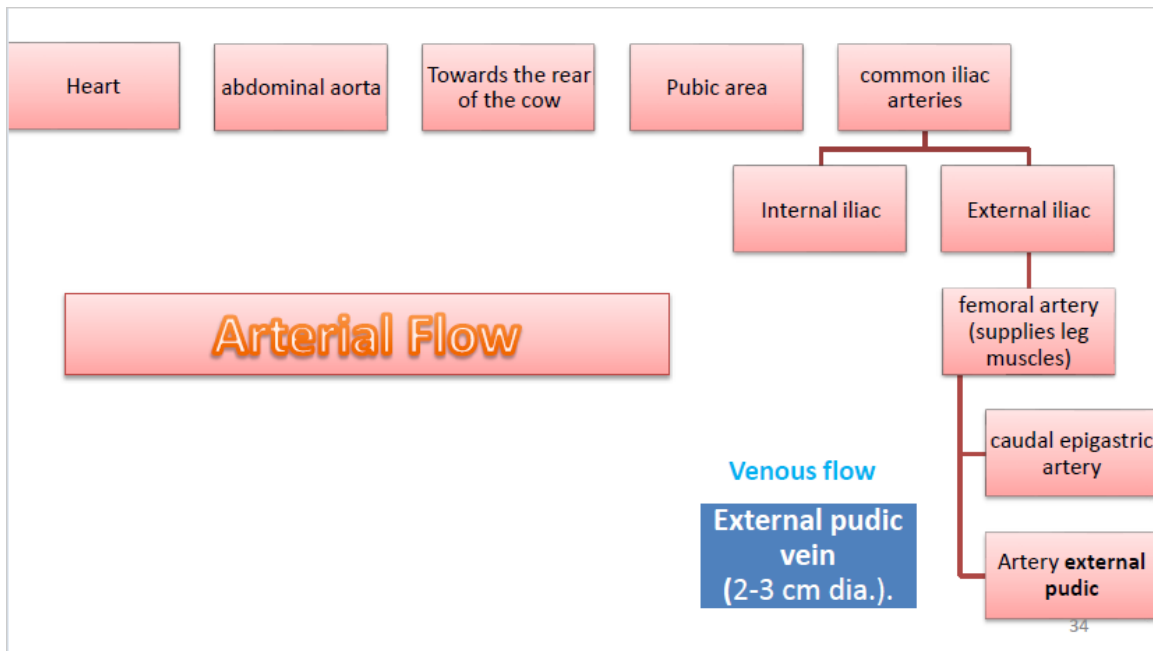
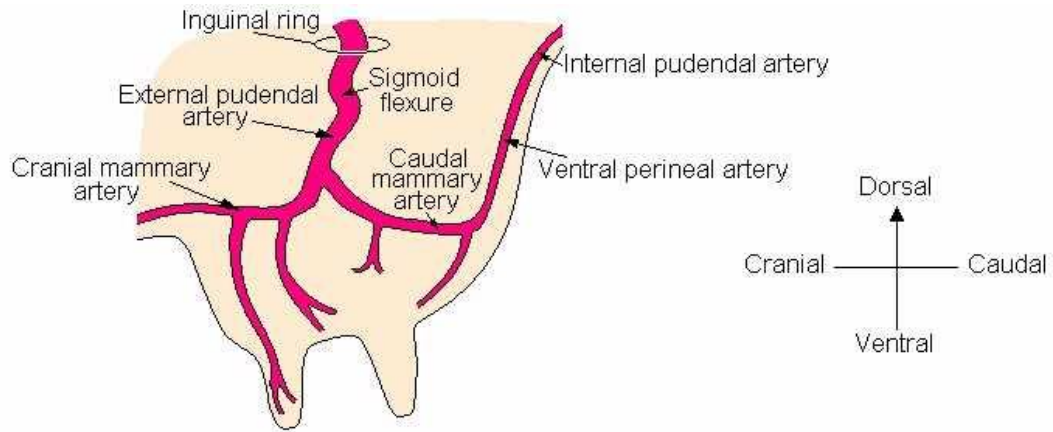
Arteries:

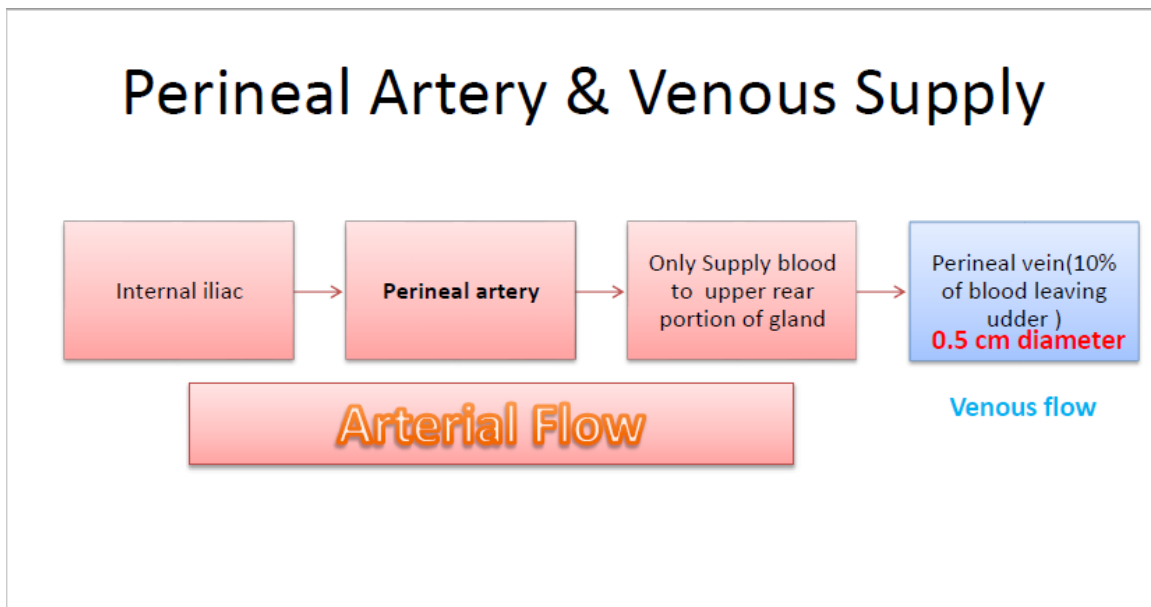
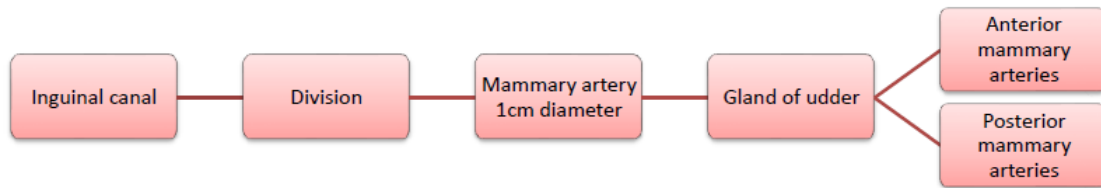
The main blood supply to the inguinal mammary glands is from the **external pudendal artery**. This arises indirectly from the external iliac artery via the deep femoral artery. The external pudendal artery passes through the inguinal canal. In species which also have **thoracic and abdominal mammary glands** (bitch, queen, sow) additional blood supply is derived from the **internal thoracic artery** and its branches - cranial superficial epigastric arteries as well as from **lateral thoracic** and **intercostal arteries**.

Blood supply

- Arteries
- External pudendal artery
- Internal thoracic artery
- Lateral thoracic artery
- Intercostal artery
- Veins
- Cranial superficial epigastric vein
- Internal thoracic vein
- Caudal superficial epigastric vein
- External pudendal vein
- Pudendal nerve
- Superficial inguinal lymph node





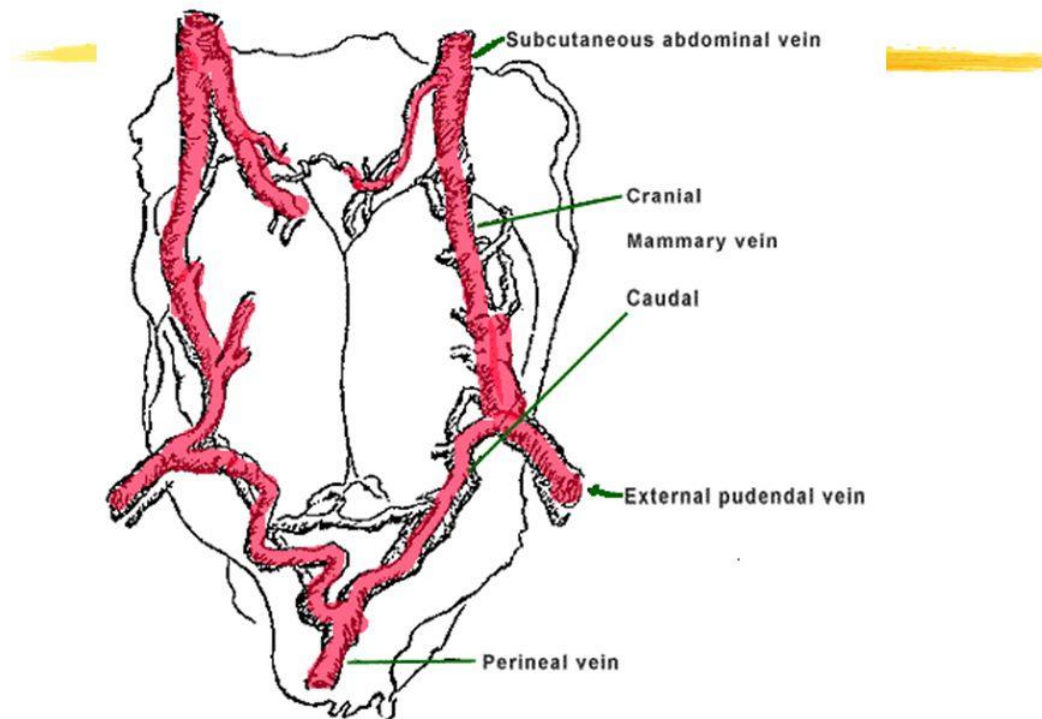


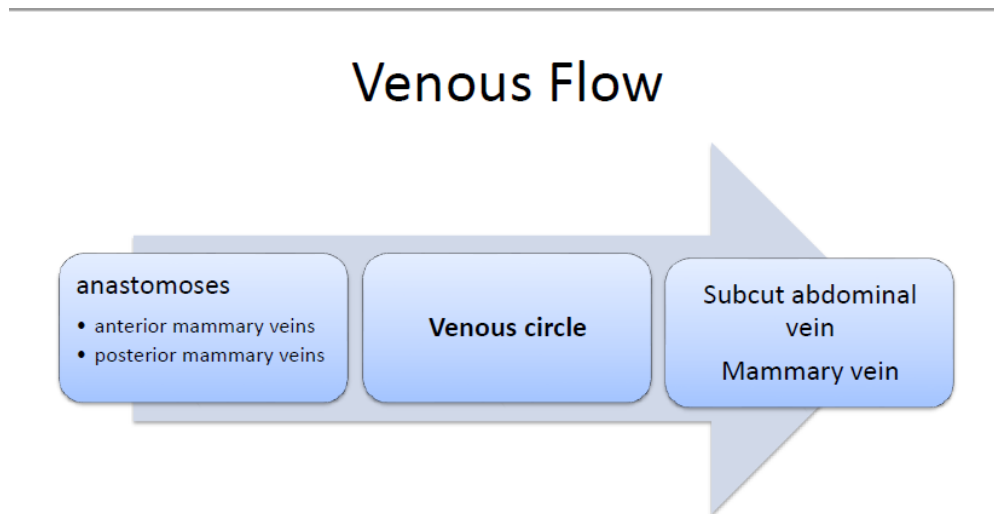
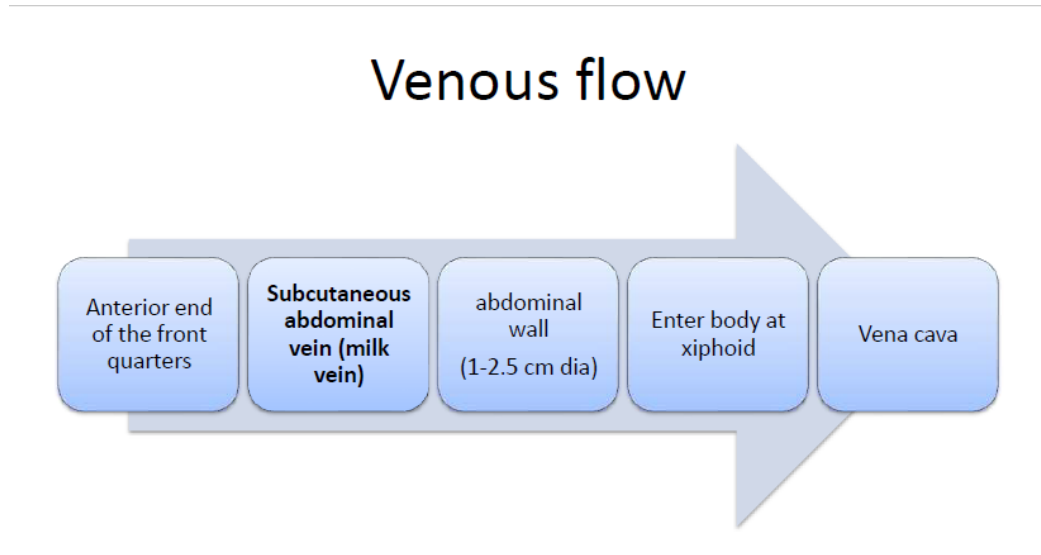
Veins:

In most species **thoracic and cranial abdominal mammary glands** drain via **cranial superficial epigastric veins** into the **internal thoracic vein**. **Caudal abdominal and inguinal mammary glands** drain via **caudal superficial epigastric veins** into the **external pudendal vein**.

In cattle a venous ring is formed between the base of the udder and the abdominal wall. During the first pregnancy, an anastomosis develops between cranial and caudal superficial epigastric veins forming the **subcutaneous abdominal vein** (milk vein). As a result some drainage from venous ring passes in a cranial direction via this vessel, which then drains deeply through the abdominal wall (milk well) into the internal thoracic vein. Other drainage passes to the external pudendal veins or to perineal veins.

Venous Circle

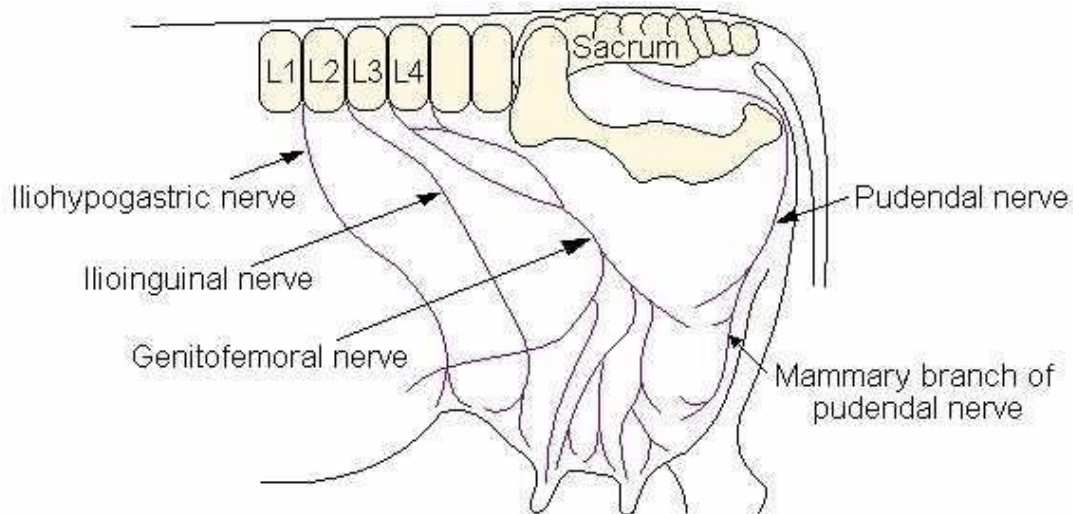




Innervation:

Somatic innervation is via the ventral rami of the spinal nerves. In the cow, the ventral branches of L1 and L2 (**iliohypogastric and ilioinguinal**) supply the skin of the cranial glands. Mammary branches of the **puddendal nerve** supply the

caudal aspect of the udder. There is sympathetic innervation to the blood vessels and teat sphincter smooth muscle. Mammary glands also have major influence from endocrine hormones.



Lymphatics:

The more caudal mammary glands drain to the **superficial inguinal lymph node** and the more cranial mammary glands to the axillary or sternal lymph nodes.

Lymphatic drainage in the cow:

The **afferent lymphatic ducts** pass dorsocaudally to reach the **superficial inguinal** (mammary) lymph nodes at the dorsocaudal side of the udder. These are usually palpable large, kidney-shaped nodes between the caudal side of the udder base and the thigh. The **efferent lymphatic ducts** pass into the abdomen through the inguinal canal to empty into the deep inguinal node.

Species differences

Position and Morphology

Species	Primates	Elephant	Goat and Sheep	Guinea Pig	Cow	Mare	Rat	Dog	Sow	Cat
Number of Mammae/teats	2	2	2	2	4	4 (2 teats)	~10	~10	8-18	8
Position	Pectoral	Pectoral	Inguinal	Inguinal	Inguinal	Inguinal	Abdominal, Ventral	Thoracoabdominoinguinal	Thoracoabdominoinguinal	Thoracoabdominal
Teat Ducts	10-20	Several	1	1	1	2	1	8-22	2	4-8

Surgical affections of the udder and teats

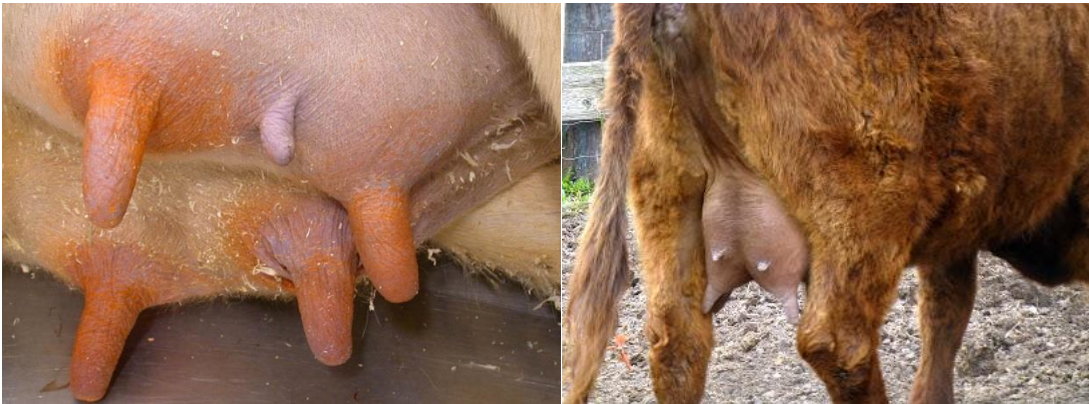
Most of surgical procedures of the udder and appendages are performed on the bovine are the same adopted on small ruminants and other large species. Surgical affections of the udder and teats may be either congenital or acquired as follow:

Congenital anomalies:

- 1. Absence of the udder:** Is exceedingly rare and only met with in cases of hermaphroditism.
- 2. Supernumerary glands:** Occurs only in multi-parous animals.
- 3. Absence of the teat.**

4- Supernumerary teats:

This may occur and can be present anywhere on the udder but are most frequently seen posterior to the last two normally placed teats. These additional number teats may or may not have adjacent glandular tissue that will become functional. If there is a glandular tissue that has a functional potential, it will atrophy if not milked.



Treatment:

It is better to amputate the accessory teats when that animal is young heifer, before the gland becomes active. It is essential that care must be taken to assure that only the supernumerary teats are removed and not normal. It may be desirable to remove the supernumerary teats for cosmetic reasons or because some may be so close to normally placed teats that they interfere with milking procedures.

Procedure:

Infiltrate the base of the teat by means of 2 % Xylocaine as local anesthetic. An elliptical incision is made including the necessary teat. Crush the tissue and the skin is then sutured in an interrupted pattern.

5. Contracted sphincter or teat orifice "hard milker":

The condition may be congenital in origin or may be acquired as a result of trauma to the end of the teat. There is a small stream of milk, and prolonged milking time. There may be loss of milk due to incomplete milking or trauma to the teat due to attempts for strenuous milking methods.

Treatment:

Local infiltration anesthesia or instillation of 5 ml of 2 % xylocain or similar local anesthetic into the teat canal will provide anesthesia. The orifice should be cleansed, antiseptic applied, and the orifice enlarged. The enlarging procedure may be accomplished by inserting of lichtig teat knife, ringed teat splitter or still teat bistoury. The opening in the sphincter is maintained at the desired size by inserting a Larson teat tube and leaving it in place for 5-7 days. Milking is accomplished by removing the cap of the tube.

6. Enlarged teat orifice "Free Milker" or (Leaker):

This condition is due to a relaxed or a traumatized sphincter. Milk leaks from the teat at times other than milking and result in milk loss.

Treatment:

The condition may be helped by injecting small amounts of sterile mineral oil or lugol's solution around the orifice to reduce its size to the desired effect. This may have to be done more than once to obtain the optimal size for milk flow. If it is overcorrected and result in stenosis, handle as contracted sphincter or orifice.

7. Occlusion of the teat orifice:

This is a congenital anomaly characterized by the occlusion of the teat orifice deposit the teat fills with milk at the time of lactation. It may also be acquired as a result of trauma at the teat orifice that results in healing with occlusion.

Treatment:

A small amount of local anesthetic is injected into the area. Insert a septic hypodermic needle where the opening should be located. Insert the needle into the teat canal until milk flows out; then withdraw the needle and enlarge the opening as described for contracted sphincter.

Acquired surgical affections:

1- Lacerations:

Lacerations of teats and or udder that do not penetrate sufficiently to allow milk to flow from the wound may be handled as any other laceration, keeping in mind that large amounts of scar tissue or flaps of skin may interfere with milking or have an undesirable cosmetic effect. Lacerations or trauma in the area of the teat sphincter may lead to stenosis. If there are flaps of skin that protrude, they should be sutured or removed. Portions of nonviable skin should be trimmed back to conform to normal contour of the teat.

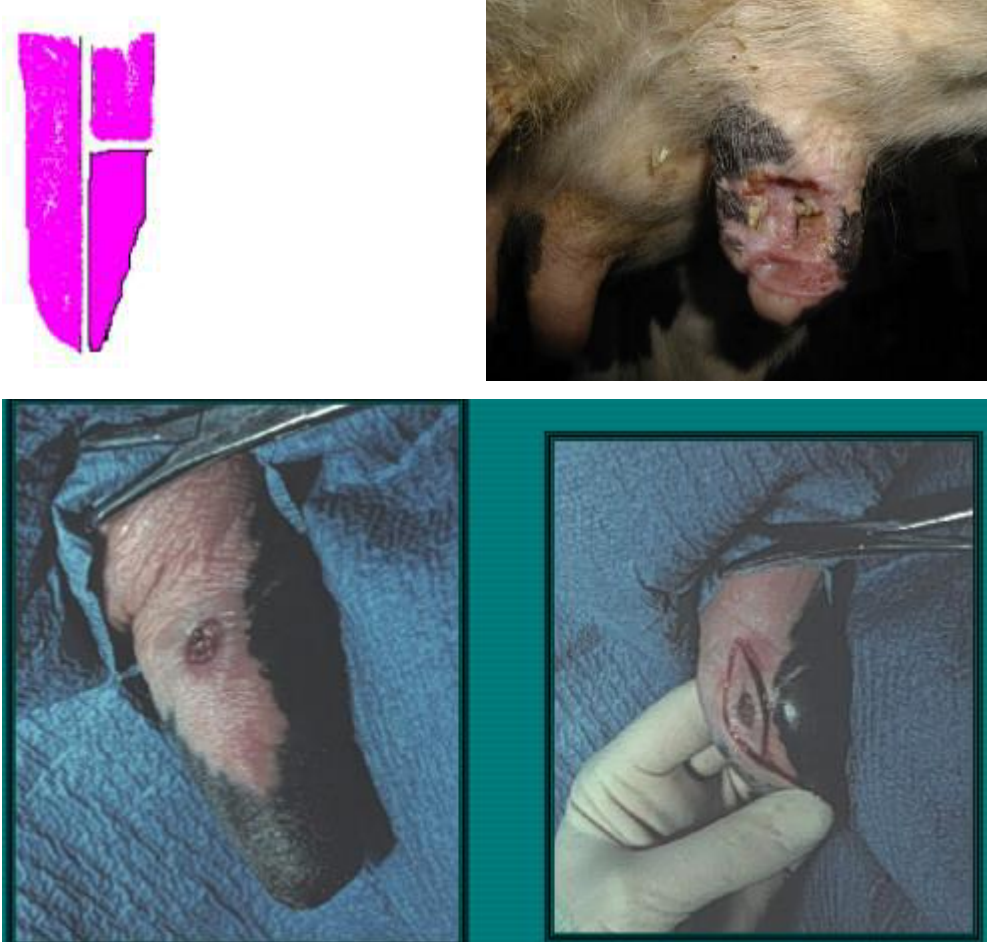
Sutured wounds may be protected by a wrap of an adhesive elastic bandage. The insertion of a Larson-type teat tube to facilitate milking is of value to the person milking as well as to the animal because the pain associated with the trauma. Replacing the cap on the tube after milking will reduce the possibility of mastitis.



2- Teat Fistula:

The term, teat fistula, refers to an opening in the wall of the teat, connecting the exterior to the pre-existing channel, the teat canal is characterized by persistent outflow of milk. Such fistula may be congenital or acquired. It is mostly acquired as a result of penetrating wound that extend to the teat canal or cistern and fails

to heal completely because of the continuous drainage of milk. Fistula will vary in size from that one which is so tiny, it is difficult to locate to large ones through which the mucous membrane may be seen.



Treatment:

1. Anesthesia can be obtained by a ring block at the base of the teat or local infiltration anesthesia of the wound edges using 2 % solution of xylocaine Hcl.
2. The entire area is prepared for aseptic surgery by washing the field of the operation with soap and water, swap with alcohol. Tincture iodine should never be used because of its marked irritant effect.

3. Apply a suitable tourniquet as the rubber tube of the blood transfusion set at the base of the teat or teat band as much high as possible to secure haemorrhage during the operation.
4. The wound edges should be, if necessary, debrided before suturing. If the fistula is old and the tissue around it have healed, the tract should be excised before suturing.
5. Apply a teat siphon to guard against injuring tissues of the other side and to avoid excessive trimming.
6. The teat fistula is then sutured after dusting the site with an antibiotic powder.

The suture is carried out in two rows including all layers with the exception of the mucosa using non absorbable, noncapillary suturing material. A vertical mattress or similar stitch is used to effect the apposition of the edges deep in the tissue and superficially. The apposition must be complete and firmly held in place or milk seepage will cause the fistula to recur.

7. A teat bougie is applied to prevent adhesion of both sides of the teat cistern.
8. An elastic adhesive bandaged is wrapped around the teat to reduce milk pressure on the sutures and by virtue, to protect the wound.
9. The tourniquet is then removed. The stitches may be removed in 10-14 days post operatively. Remove the bandage after 5-7 days.

Siphoning the milk every now and then (2-3 days). Intramammary infusion of broad spectrum antibiotic udder ointment to guard against mastitis. Apply the teat bougie. Care must be taken that it is contraindicated to carry out such surgery if mastitis is supervening or the lips of the wound are oedematous. This should be first treated before the surgery.

3- Haematoma of the udder:

Haematoma of the udder is relatively common in cattle having pendulous udder as a result of contusion and rupture of a subcutaneous blood vessels. The condition is characterized by its sudden onset and fluctuency. A septic puncturing the swelling may be necessary to confirm diagnosis, but this is not preferable. If

the haematoma is subcutaneously, it can be palpated out if parenchymatus it cannot be detected by visual examination and the diagnosis in such cases depends upon the sudden onset of bloody milk.



Treatment:

Small haematomas of the udder should never be opened immediately. Opening the haematoma is after a week post occurrence. The blood clot is removed and the cavity is painted with tincture of iodine. The cavity is then packed tightly to guard against further bleeding. Large haematomas in front of the udder should not be opened till the blood is clotted, usually after 10 days and proceed as before.

4- Lactiferous Calculi (Milk Stones):

Milk stones which are found in the udder may result from accumulation of lime salts of milk over a point of crystallization. The latter may be desquamated epithelium. Sometimes, these calculi are freely movable in the teat canal if their sizes relatively smaller than the diameter of the canal. When being larger in size, they obstruct the lumen of the teat canal.

Treatment:

If the calculi are of small size, they can be removed by manipulation during milking. Larger calculi obstructing the teat canal can be crushed by means of special forceps. In other cases of milk stones, it may be necessary to enlarge the opening at the end of the teat by cutting through the sphincter of the teat canal one or more times.

5- Abscess of the Udder:

Abscesses of the udder may develop beneath the skin as a result of infection of a haematoma. It may occur in the parenchyma of the udder as a result of chronic mastitis especially in goats. It may also occur as a result of supramammary lymphadenitis. Generally, abscess formations most commonly occurs secondary to the traumatic wound.



Treatment:

Following confirmation of diagnosis, the treatment should be done on the general principles for treatment of abscesses. If there are multiple abscesses, mastectomy (partial or total) according the involvement of one quarter or more on the entire udder, is then indicated. If there is involvement of the supramammary lymph node, lymphadenitis it should be extirpated.

6- Membranous obstruction of the teat canal (teat spider or blind quarter):

This condition may be congenital associated with failure development of the teat cistern or teat canal, or acquired due to mastitis, trauma, or tumors.

Symptoms:

- a- The obstruction may be high at the base of the teat or extend lower down in the canal.
- b- The obstruction is noted at the onset of lactation when it is observed that the quarter development normally but milk flow is hindered or absent.
- c- The obstructing membrane may be thin or quite thick.
- d- Careful palpation of the teat and mammary glands may reveal fluctuating milk above the obstruction with little or no means of outflow.
- e- In some cases, the obstruction may be so high as to allow no palpable pocketing of milk. In this case, the prognosis is poor.

Treatment:

- a- When the membrane is thin, it may be penetrated with alligator forceps in closed position then opened up to spread the opening. Alligator forceps may also be used to grasp the membrane and pull it open.
- b- Use of special instrument such as teat slitter, or teat spiral to open the membrane and result in milk flow.
- c- It is helpful not to milk the quarter completely until it heals.

Gangrenous mastitis

Gangrenous mastitis occurs sporadically during the **first three months of lactation** often associated with poor milk supply related to **ewe underfeeding** and **over-vigorous sucking** by the lambs.

The condition is more common in ewes nursing **triplets** than twins, and very rare in ewes rearing singletons. It is usually caused by organisms such as *Mannheimia haemolytica* and *Staphylococcus aureus*.

Gangrenous mastitis is a **major welfare concern** and is a sporadic cause of ewe death and loss of lambs.

Clinical signs

Gangrenous mastitis is often preceded by lesions on the udder and teats caused by the lambs' incisor teeth.

Ewes are often dull and depressed, separated from the rest of the flock, and sometimes drag their hind leg on the side of the affected quarter.

The udder gland is usually markedly swollen with purple/black discolouration of the skin extending to the ventral abdominal wall.

Affected ewes will show a marked loss of condition due to the toxaemia, and the gangrenous udder tissue eventually sloughs leaving a large granulating lesion with superficial bacterial infection. Granulation tissue can continue to proliferate over the following months.

Diagnosis

Diagnosis is made on the basis of the clinical signs and culture of a swab of the area might reveal the organism involved.

Treatment

Prompt antibiotic and supportive therapy should be instituted, such as procain penicillin injections and anti-inflammatories. Lambs from the affected ewes should be housed and given supplementary feeding.

Topical antibiotics can also be applied to any udder or teat lesions to prevent progression of the disease.

Ewes with a severe form which have lost part of their udder are unsuitable as breeding stock and they should be culled during the acute phase of the disease.

Warts

Warts are caused by viruses.

Warts can be cauliflower like or thin and long in shape. There are up to 7 different shapes.

Warts sometimes disappear within 2 months but sometimes they persist and have to be removed.

Cattle can also be vaccinated against warts. The vaccine used is made from warts.

Treatment

Cattle can also be vaccinated against warts. The vaccine used is made from warts.

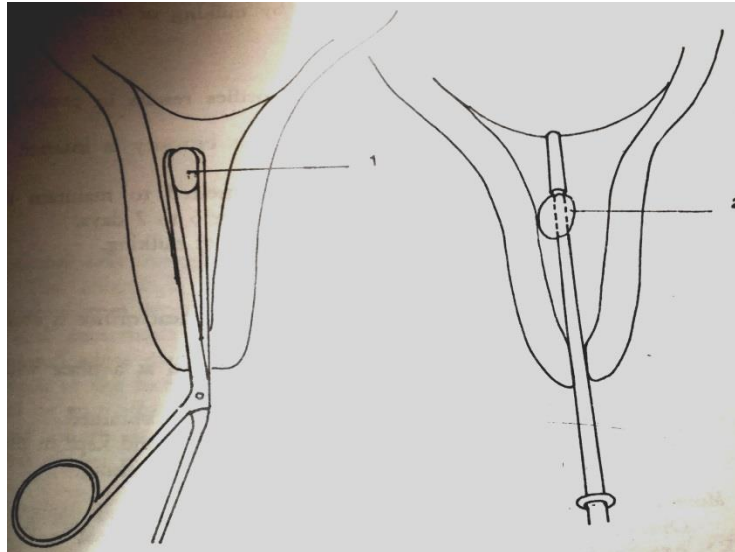
Polyps of the Teat canal.

These are small peace growths attached to the wall of teat canal.

The polyps hinder the milking process and sometimes even block the passage of teat canal. Teat polyps can easily take out by Huges teat tumor extractor (in which teat tumor extractor is inserted into the teat canal after ascertaining

(determining) the location of polyps). If its location is above the teat canal surgically removed. The polyps are excised (removed) by milking or relieved with alligator forceps.

Postoperative Gentamicine and prednisolone infusion for 5 consecutive days found suitable to check infection as well as helpful in checking further growth of the polyp.



Surgical removal of lactolith and polyp, 1. Crushing of lactolith by alligator forceps, 2. Removal of polyp by teat tumor extractor

Tumor of mammary gland.

These are infrequently in lactating animals, fibro adenoma reported in heifer.

Surgically removed under caudal block or local infiltration analgesia.

Udder amputation, mastectomy, remove of the mammary gland.

Indication:

- Chronic mastitis not responded to treatment.
- Mastitis - infection within one of the quarters in the Gangrenous mastitis.
- Mastitis in dairy cattle is the persistent, inflammatory reaction of the udder tissue.
- Mastitis, a potentially fatal mammary gland.
- Gangrenous mastitis.
- Udder tumors.
- Rapture of the suspensory ligament.
- Keep the cow for breeding purpose.
- Keeping the cow as a donors in embryo transfusion.
- Before slaughtering for meat healthy for human consumption.

Principles of the surgical approach of the teat and udder.

Preparation of the patient.

Off food 24 hours prior to the operation and water few hours before the operation, especially in case of mastectomy.

Sedation or muscle relaxant to restraint the animal.

Insert the stomach tube.

Insert the endotracheal tube.

Put the animal in the lateral position or in the semi dorsal position, with the hind limb distended.

Prepare the fluid therapy and the blood (to prevent shock due to great loss of the soft tissues and blood).

Prepare the site of operation by clipping, shaving, wash with soap and tap water, and disinfect the site of operation.

Cover all the body with sterile drapes except the field of operation (surgical incision).

Operating room.

Must be wide, clean, good ventilation, supplied with source of hot and cold water, easy to clean and drainage.

Type of anesthesia.

Local anaesthesia:

Infusion with local anaesthetic, inverted V- block ring block.

Regional anaesthesia:

Perineal nerve block may be used for surgery on the caudal teats and the escutcheon of the udder.

Epidural anaesthesia may be used as an alternative to local analgesia for teat surgery in cows.

lumbar paravertebral anaesthesia (blocking L1, L2, L3) or segmental lumbar epidural anaesthesia may be used in the standing cow,

General anaesthesia: This is occasionally indicated for teat surgery.

Surgical procedures:

Surgical incision at the midline caudal to the base of mammary gland then cranially at the mammary base.

Skin separation bluntly from the lateral side of the body, (leave skin flaps to cover the area after udder amputation).

Find the blood vessels then stop bleeding by two transfixing sutures using no. 1 non absorbable suture materials the fold the end for more secure from bleeding (pudendal artery and veins, perineal artery and veins, and large subcutaneous veins).

Cutting the suspensory ligaments (two lateral and one middle suspensory ligaments).

Then the same technique in the other side of the body.

Remove the mammary gland, Suture the skin flaps to the body with non capillary no absorbable suture materials no.1 or 2 (not to leave space or sinuses) to prevent the infection. Healing by granulation tissues.

Post operative care:

- Daily checking the skin incision (from inflammatory signs, rupture of the stitches, hernia, hematoma, stitches abscess).
- Daily topical treatment of the sites of incision and Pain killer.
- Daily injection of systemic antibiotics 3-5 days.
- Kept the animals away from other animals in clean stable.
- Remove the suture materials 7-10 days post operation.

Complication of the operation:

- Bleeding.
- Abscess and Stitches abscess.
- Subcutaneous emphysema.
- Hernia.
- Adhesion.
- Infections and Death occurs due to shock.