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1: SPECIAL EXAMINATION OF THE DIGESTIVE SYSTEM IN CATTLE

The examination of the digestive system is carried out organ by organ, from the mouth to the rectum

EXAMINATION OF THE ORAL CAVITY AND PHARYNX

Examination of the oral cavity should be carried out systematically whenever:

- Difficulties in grasping or chewing food,
- Excessive salivation.

Note: Caution if rabies is suspected: risk of infection.

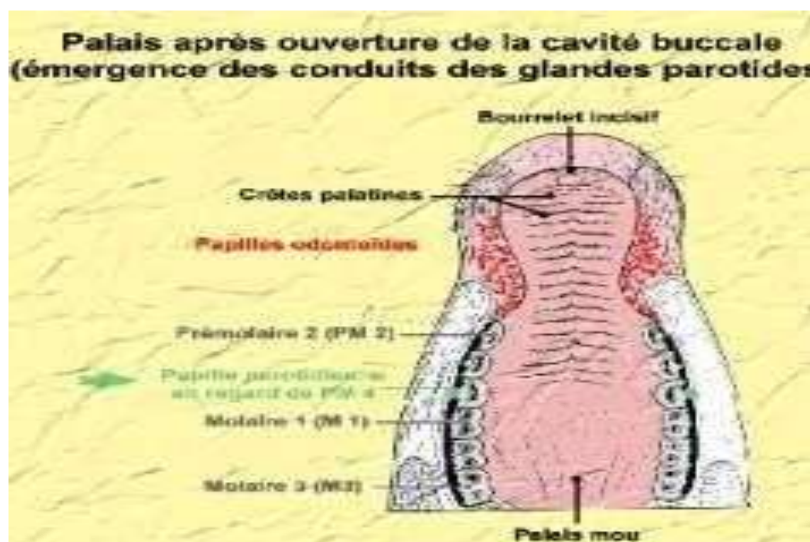

Figure 1: Roof of the oral cavity

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Figure 2: Floor of the oral cavity

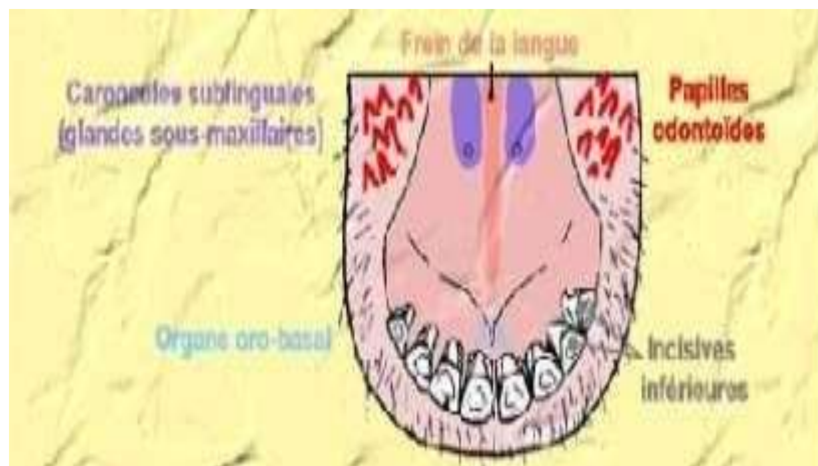

Figure 3: Floor of the oral cavity

External inspection and palpation

A. Salivation

First, check the amount of saliva produced; normally, an adult bovine produces 100 to 190 litres of saliva daily. It is clear, slightly viscous, and constantly swallowed. There are two distinct cases:

Ptyalism due to hypersalivation: This is an abnormally high production of saliva, resulting from any inflammation of the oral cavity (whether specific or not, such as mucosal disease, papular stomatitis, foot-and-mouth disease) and organophosphate poisoning.

Pseudo-ptyalism (sialorrhoea): In this case, the saliva is not swallowed, or only swallowed in small amounts, but is not produced in greater quantities; it is observed in cases of a disorder of the swallowing process (pharynx, oesophagus).

Secondly, the following are examined: the consistency, the possible presence of food fragments, blood, pus and tissue particles, as well as the odour of the saliva.

B. Examination technique

- ***External inspection of the oral cavity***

Observe from the front and then from the side:

- The lips (upper and lower).
- The chin.
- The infraorbital region.
- The cheeks.
- The nasolabial region.
- The salivary gland region (submandibular, parotid).
- The bony structures.
- Pharynx.

Figure 4: Inspection of the oral cavity from the side

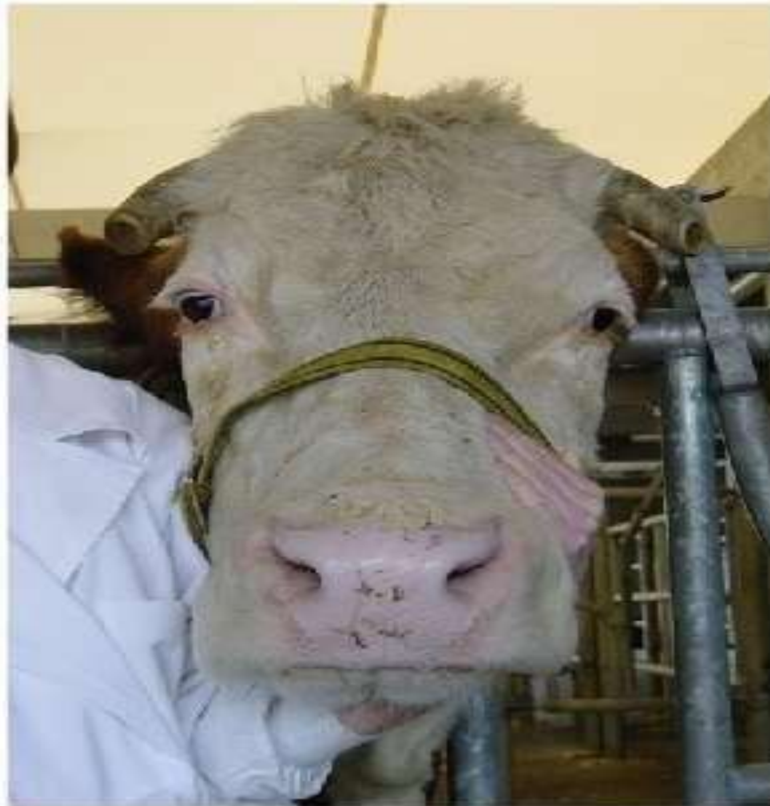

Figure 5: Inspection of the front of the oral cavity

The aim of the external inspection of the oral cavity is:

- To look for an increase in the volume of tissues surrounding the oral cavity
- To note any deformities, for example in cases of actinobacillosis, actinomycosis, etc.
- To note any injuries.

Figure 6: Actinomycosis in cattle

- **External palpation of the oral cavity**

Palpate in the following order

- The lips (upper and lower).
- The chin.
- The infraorbital region.
- The cheeks.
- The neck region.
- The salivary gland region (submandibular, parotid).
- The bony structures.
- Palpation of the lymph nodes of the head: Mandibular lymph nodes (submandibular), Parotid lymph nodes, Retropharyngeal lymph nodes.

Internal inspection and palpation

A. ***Opening of the oral cavity and inspection of the anterior part of the oral cavity***

• Insert the hand laterally between the incisors and molars

• Pull the tongue, held with a dry cloth, from one side and then the other.

Once the oral cavity is open, the following can be observed:

- The lips,
- The gums,

- The soft and hard palate,
- The buccal space,
- Sublingual caruncles,
- Teeth: colour, alignment, wear...
- The tongue: its examination can guide the diagnosis:
    - Soft tongue: Botulism
    - Wooden tongue: Actinobacillosis
    - Large vesicles on the tongue: suspicion of F.A.

Mucous membranes are physiologically pink.

Figure 7: Technique for opening the oral cavity

Figure 8: Internal inspection of the oral cavity

Figure 9: Ulcerative lesions and ptyalism in a cow affected by bluetongue

B. Inspection of the deep part of the oral cavity and the pharynx

Examine the pharynx using a lamp and speculum to pass the tongue.

• Pulling the tongue between the molars

• Thanks to a gap between the upper and lower jaws.

• As the tongue root often obstructs inspection of the pharynx, it is recommended to use a tubular speculum.

• When palpating the oral and pharyngeal cavities, the hand should be inserted vertically and straight, rather than horizontally and spread out, to avoid injury from the molars.

Figure 10: Equipment required for inspection of the pharynx

C. Assessment of the odour of the oral cavity

• By diverting the exhaled air towards your nose using your hand.

The normal odour is slightly sweet and bland.
The odour of the oral cavity may be a diagnostic clue

- A putrid oral odour is pathological and may originate from the mouth, pharynx, oesophagus, rumen or lungs.
- In cases of acetonemia, the odour is that of an unripe apple.
- An ammonia-like odour is observed in cases of renal failure.

D. External palpation and pressure of the pharynx

This is performed using both hands, with the fingertips, applying pressure and counter-pressure. It is painless.

- ***Palpation and pressure of the pharynx from above***
- ***Palpation and pressure using a cornet:*** this is identical to palpation and pressure without a cornet, but performed from below.

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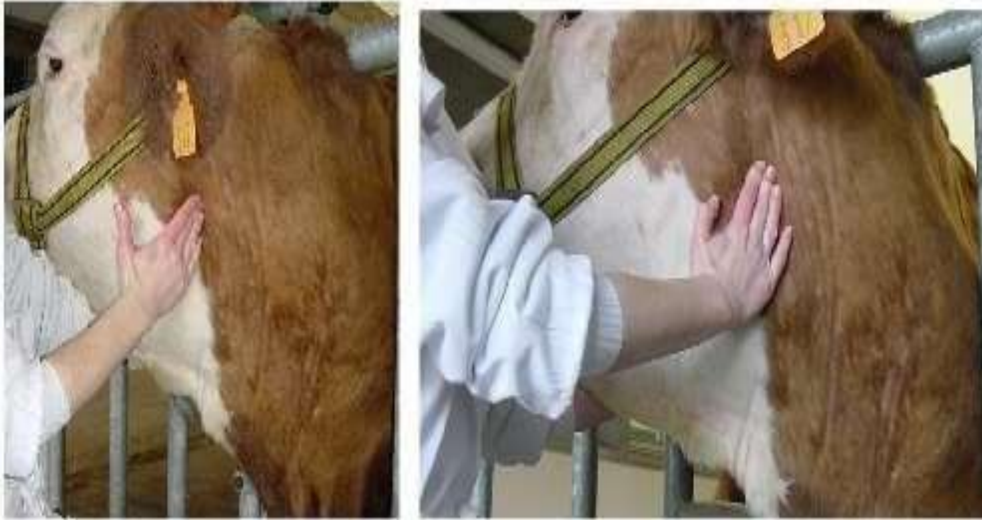

Figure 10: Palpation and pressure of the pharynx from below

E: Internal palpation and pressure

When opening the bovine oral cavity, one must:

- Measure the force exerted by the maxilla
- Assess the strength of the tongue and its mobility during grasping.

Cattle have lateral mandibular movements; palpation and pressure are therefore performed with the hand held vertically, whilst the mouth is held open by a gag or a stick.

- Insert the hand vertically between the cutting edges of the teeth and the cheeks, then between the teeth and the tongue.
- Palpate with the fingertips:
  - The jugal space
  - The lips
  - Gums
  - Tongue
  - Hard palate and soft palate

EXAMINATION OF THE OESOPHAGUS

The oesophagus is a hollow muscular tube that allows food to pass from the mouth to the stomach. Examining it is important in cases of difficulty swallowing, regurgitation or belching; foods such as apples and beetroot can become lodged at three narrowings:

- at the exit from the pharynx
- at the entrance to the chest
- at the entrance to the cardia

When there is an obstruction of the oesophagus, the animal is agitated, shows signs of drooling, and makes swallowing efforts... One must also look for any possible swelling or pain.

Topography of the oesophagus and examination area

A. Anatomy

It is 110 to 125 cm long, with a diameter ranging from 5 to 6 cm in the cervical region. It has two bends (pharynx, entrance to the chest). And four narrowings or areas of obstruction (pharynx, entrance to the chest, above the heart and cardia). Its musculature is striated.

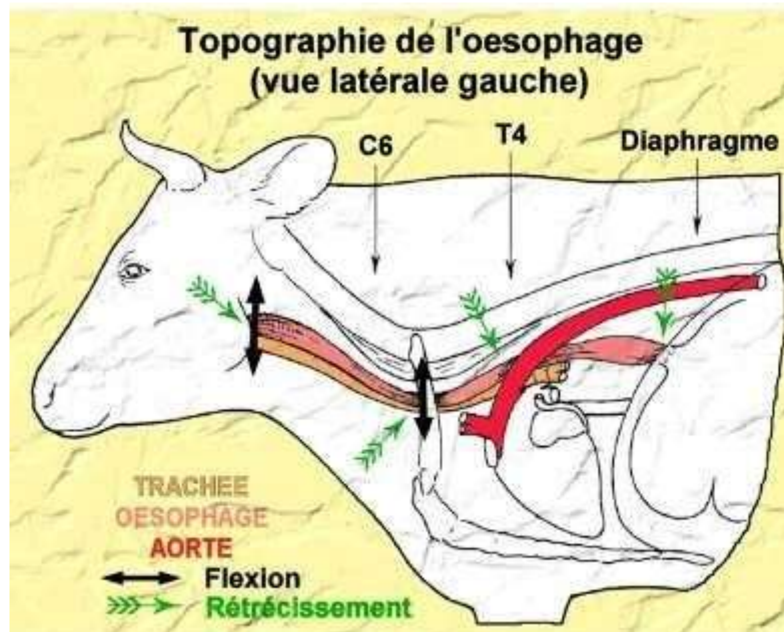

Figure 11: Anatomy of the oesophagus

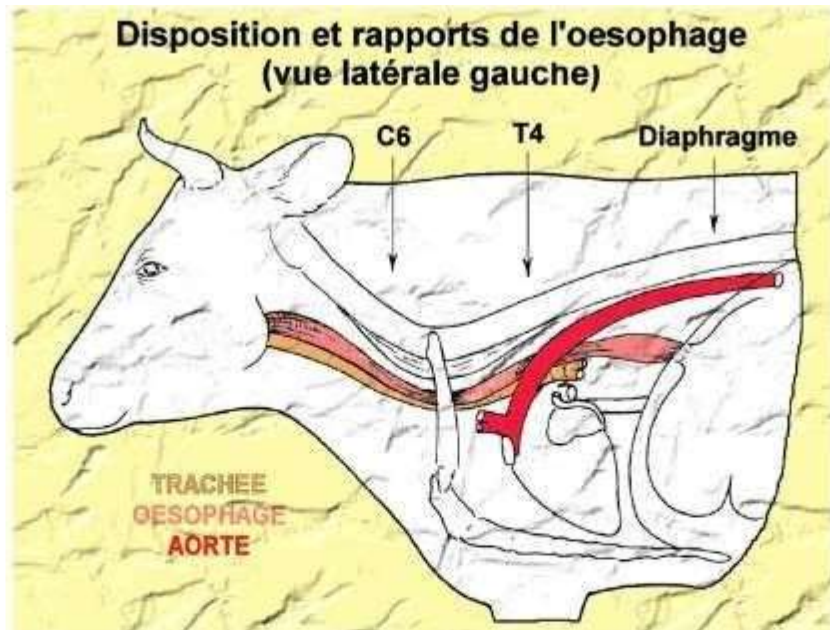

Figure 12: ***Arrangement and relationships of*** *the oesophagus*

B: Arrangement and relationships of the oesophagus

The oesophagus extends within the jugular groove, initially above the trachea, then on its left side, and again dorsally to the trachea.

- It lies mostly dorsally to the trachea.
- It deviates to the left of the trachea, from the first to the last third of the neck, within the left jugular groove.

External inspection

Inspection and palpation are only possible for the cervical portion, within the jugular groove. The animal must be probed to examine the entire tract.

- *Position yourself* 3/4 rear left.
- Observe the cervical region whilst walking (you may even distribute some feed), and during rumination:
  - The animal's behaviour.
  - The position of the head.
  - The left jugular groove.
  - The regularity of the rumen's movement.
- Note any enlargements or injuries...

Figure 13: External inspection of the oesophagus

External palpation and pressure

A. Technique

Position yourself beside or beneath the neck.

Palpation is performed with both hands, symmetrically, using the fingertips. Apply pressure

and counter-pressure to the oesophagus with both hands.

Starting at the level of the pharynx and moving gradually down the jugular grooves, above the trachea to the entrance of the chest.

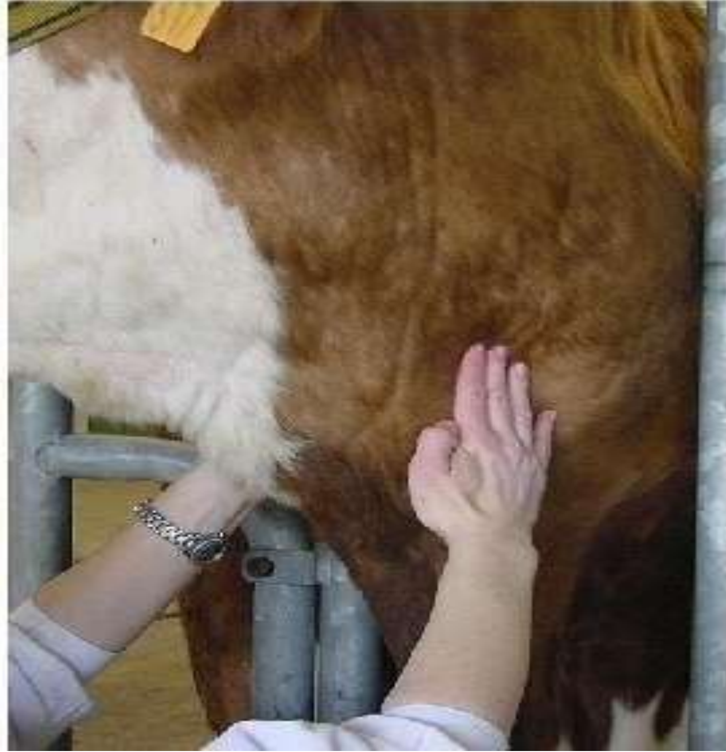

Figure 14: Palpation and pressure of the oesophagus

B. Purpose and findings

The clinician looks for:

- Increases in volume.
- Trauma and pain.
- Narrowing (oesophageal stenosis), paralysis, oesophageal dilation (enlargement of a section of the oesophagus).
- Functional disorders such as enlargement (mega-oesophagus).
- Oesophageal obstructions (foreign body)

Under normal physiological conditions, the flexibility of the oesophagus makes it difficult to palpate. Palpation and pressure are painless.

Oesophageal catheterisation

A. Technique for oesophageal catheterisation

Oesophageal catheterisation is performed using a probe, preferably metallic (to pass through the molar arches), which has been lubricated beforehand and is sufficiently long and hollow (to allow the passage of gas). Certain precautions must be taken into account:

• Proper restraint is essential.

• The probe must be correctly positioned in the head-neck axis.

• It must be advanced gently without force, as the tissues are fragile in the event of obstruction.

• A muscle relaxant may be used if necessary.

B. Benefits of oesophageal catheterisation

Oesophageal intubation allows:

- The identification of a difficulty in passing the probe due to a partial or total obstruction of the oesophagus, or a large pathological mass in the surrounding area.
- The removal of a foreign body.
- The removal of excess gas from the bowel: meteorism with rapid fermentation of carbohydrates in the absence of belching.
- After removal of the tube, its tip—which has previously been surrounded by gas—will be examined for the presence of blood, pus or tissue fragments, and its odour assessed.

EXAMINATION OF PRE-ESOMACS

Examination of the network

A. General

The **main pathologies** of the mesentery are related to **the lodging** of a **foreign body**; barbed wire fencing, a nail, etc. **Contractions** of the mesentery are very **severe** and can **cause** the foreign body **to become embedded** in the **wall**, thereby causing **indigestion** and **peritonitis**.

The clinical warning signs are: pain, chronic bloating (with digestive atony), a drop in milk production, and mild hyperthermia may also be present.

Figure 15: Peritoneal wall

B. *Area of investigation, also known as the LIESS zone*

- On **the left**: it forms a trapezium whose sides are:
  - the **caudal edge** of **the pulmonary field**; from the tip of the elbow to the intersection of this curve with a horizontal line passing through the tip of the shoulder
  - a segment **joining the tip of the elbow to the xiphoid process**
  - a segment parallel to the previous one, joining the point of intersection between the caudal edge of the pulmonary field and the horizontal line passing through the tip of the shoulder, with **the edge** of the **diaphragm's projection**
- on **the right**: it forms a **trapezium** with **a lower base**, the horizontal line passing a hand's breadth lower than the horizontal line passing through the tip of the shoulder (due to the presence of the liver).

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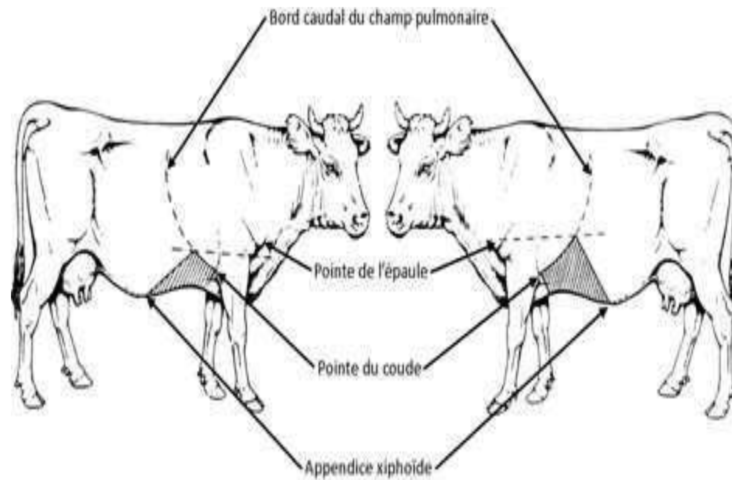

Figure 16: **Projection area of the network according to Liess (adapted from "The Clinical Examination of Cattle", Rosenberger, 1979)**

Inspection

The omentum is situated in an area where the ribs are thick and solid: this intrathoracic position prevents both direct inspection and palpation. Information can only be obtained if a foreign body that has penetrated the omental floor tends to be expelled through the abdominal wall, in which case an abscess forms in the xiphoid region.

Palpation

This allows the detection of any **abscesses** (very rare) in the **xiphoid** region. **Painful reactions** may be triggered by pressing the left hand firmly into the ^{6th}and ^{7th}**intercostal spaces** (right hand on the withers). Pain reactions may manifest as whimpering, evasion or defensive behaviour; it is therefore essential to work safely to prevent dangerous reactions.

Palpation-pressure

Various techniques have been described to identify pain of reticular origin: in fact, three indirect palpation-pressure techniques are possible:

- ***Stick test***

A solid bar of large diameter is placed transversely beneath the animal, in **the xiphoid region**, just behind the tip of the elbow; the bar must be lifted slowly but firmly and then released abruptly; repeat the manoeuvre across the entire area between the xiphoid process and the navel to cover the entire LIESS area. If, after the rod is lifted, the animal shows signs of distress, the test is positive.

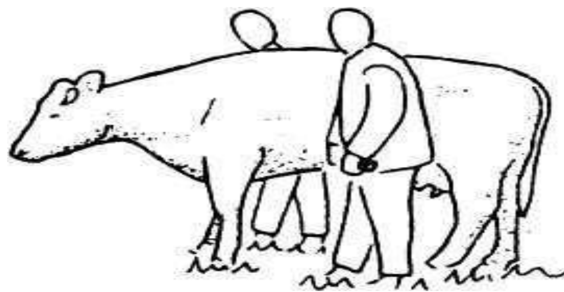

Figure 17: The stick test (adapted from 'The Clinical Examination of Cattle', Rosenberger, 1979)

- ***Withers test***

Either by pinching the spinous processes of the bovine behind the withers, or by creating a skin fold by applying light pressure to the spine at the level of the withers, the animal will normally assume a lordotic posture spontaneously.If the animal refuses to arch its back and attempts to resist the pressure applied, by vocalising or flexing its forelimbs, the test is positive (note: pain may also occur in cases of peritonitis or pleurisy...).

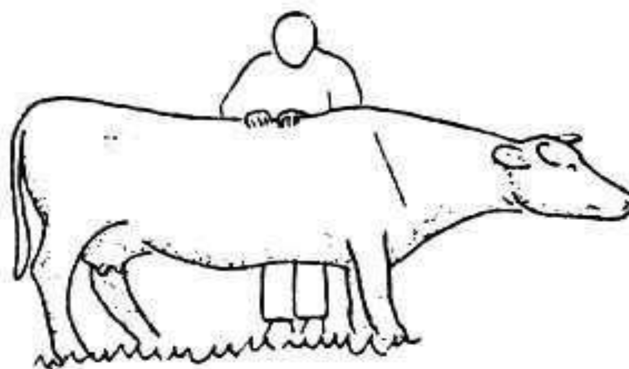

Figure 18: Withers test (adapted from 'The Clinical Examination of Cattle', Rosenberger, 1979)

- **Locomotion test**

When **the animal** is **led** down an **inclined plane**, the viscera press against the mesentery, making **the test painful**.

Percussion

This is performed with the **left fist** or a fairly heavy **hammer**; the sounds obtained are normally of a somewhat dull nature, resembling those of the rumen (lower region). It provides information on the **presence** and **location** of a **foreign body**; the sound is **tympanic**, whereas dullness is distinct or pronounced in the case of an abscess or impaction.

Auscultation

The stethoscope should be placed over the posterior half of the depression on the underside of the sternum. This is often done on the left side, between **the sixth and seventh ribs**; the network contracts on average every 50 seconds. Auscultation allows one to hear the contractions of the network, which are 'gurgling' sounds followed by a liquid sound. Other sounds may be detected, such as swallowing, belching and rumination.

- **Normal sound**: a gurgling sound lasting 10 to 20 seconds, preceding rumen contraction; this corresponds to the passage of fluid material through the reticulo-omasal orifice

Look **for a** complaint or simple respiratory arrest occurring simultaneously with the full contraction of the rumen (the second phase of the biphasic contraction), in cases of traumatic reticulo-peritonitis**.**

Further investigations

- **Ultrasound**: this allows observation of thickening of the rumen wall and altered motility
- **Magnetic resonance imaging**: it is useful but limited by the fact that it does not specify whether or not the foreign body is embedded
- **X-ray**
- Blood test for **complete blood count**: changes in the leukocyte count (inflammation) with **an increase** in **polymorphonuclear cells**, particularly **neutrophils,** in cases of **traumatic reticulo-peritonitis**; this is a useful but non-specific test
- **Exploratory laparotomy**

Physical examination

A. General

The rumen is a large, bilobed sac, elongated from front to back. The rumen mucosa is covered with papillae (ranging from 2 mm to 2 cm); these papillae are keratinised, but the epithelium is thin and highly vascularised. The main role of the papillae is to absorb the products of microbial fermentation. The rumen volume is approximately 150 litres in adult cattle. It is the largest digestive reservoir in which food broken down by the microbial flora is stored.

The aim of the rumen examination is to detect any impairment of the motility of the forestomachs of primary or secondary origin, as well as any change in the volume and consistency of its contents.

Figure 19: Rumen wall

B. Topography and projection area

In the normal state of distension, the rumen occupies practically the entire left half of the abdomen, from the diaphragm to the entrance to the pelvis and from the sublumbar region to the ventral wall, thus lying behind the projection of the lungs and in particular at the level of the left flank. Depending on its state of distension, the ventral sac extends to a greater or lesser extent towards the right side.

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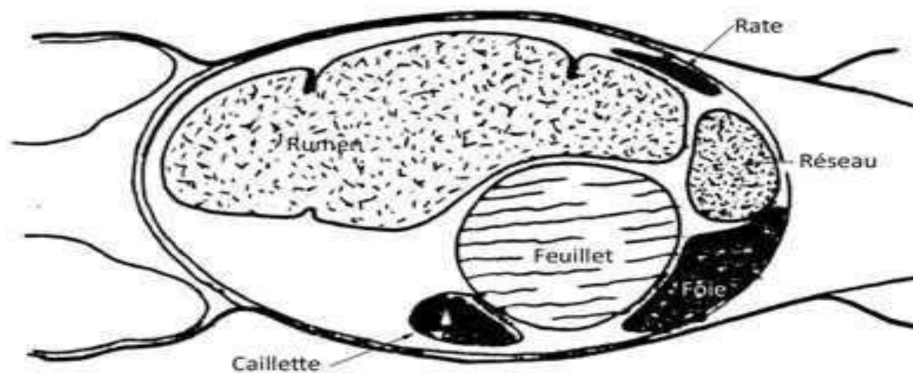

Figure 20: Theoretical horizontal section of the stomachs (clinical examination of cattle)

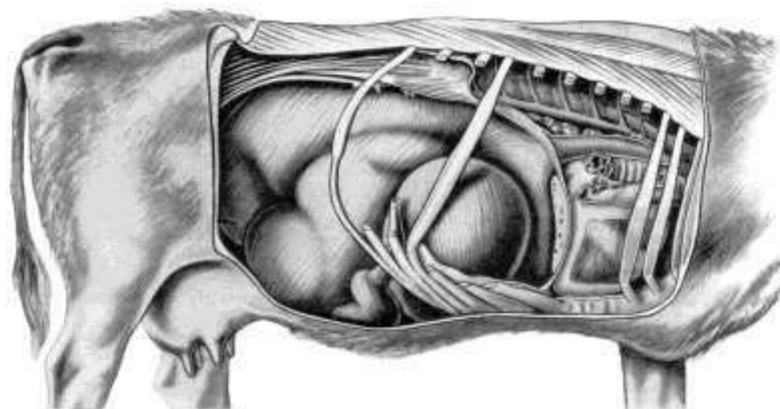

Figure 21: Topographical relationships of the rumen (right view, Rosenberger 1979)

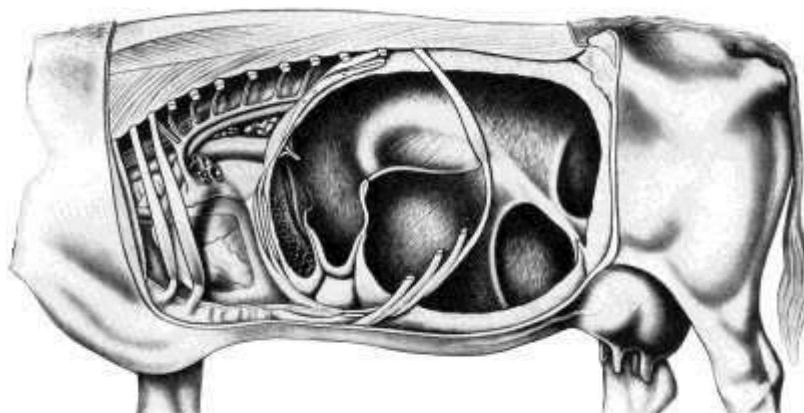

Figure 22: Topographical relationships of the forestomachs (left view, Rosenberger)

Inspection

The left flank should be observed from ¾ rear or ¾ front (hollow, chord and receding). The examination must be symmetrical to assess even subtle changes.

During the inspection, note:

• the appearance and mobility of the flank depression corresponding to the contractions of the dorsal sac

• the frequency and intensity of the contractions

• a reduction in contractions in cases of chronic indigestion

Palpation

This not only reveals the contractions but also, using the tips of the outstretched and pressed fingers, or with the fist, allows one to assess:

• the emptiness or fullness of the rumen

• the consistency of the stratified contents. In fact, at the rumen level, there are three zones: the upper zone, which is reduced and elastic due to gas accumulation; a middle zone that is soft and pasty, containing coarse forage; and a lower (ventral) zone that is fluctuating, containing very fine particles and fluid.

• Sensitivity: pain in cases of rumenitis

When gas accumulates (gaseous or frothy meteorism), the projection of the upper part becomes more pronounced; the abdomen becomes very distended, elastic, and bulges dorsally on the left.

If there is an overload of solid food, the fingers penetrate only very slightly on palpation. In cases of rumen distension with a flaccid wall and liquid contents, a sensation of fluctuation on palpation indicates functional stenosis of the omasal orifice. If the contents are highly liquefied, ruminal acidosis is suspected.

Rectal palpation allows for a better assessment of the contents, particularly the dorsal portion. The ventral sacs are accessible. Similarly, in calves, it is easy to detect the presence of trichobezoars and caseinous masses via this route.

Pressure

This can be performed using the fist, fingertips or knee, particularly at the level of the flank. Under normal circumstances, pressure does not cause tenderness.

• If the consistency is very elastic (meteorism), the contents are gaseous

• If the consistency is pasty, the indigestion is chronic

Percussion

Performed using the fingertips directly on the left abdominal wall (digital percussion) or using a plethysmographic hammer on a thin metal plate. It is intended to provide information on the sound produced by the organs on percussion. This procedure also highlights pain in cases of peritonitis or large abscesses.

In a physiological context, rumen percussion reveals:

- an upper zone, which has a relatively small lower horizontal border containing fermentation gases and produces a sub-tympanic to tympanic sound.
- an intermediate zone, about a hand's width wide, containing coarse forage, which produces a sub-dull sound with a horizontal upper boundary, slightly raised towards the rear
- a fairly large ventral zone, containing fine particles, consisting of a liquid mass, which produces a fairly dull sound.

Examples of pathological changes in sound:

- Mati-ténette: Overload with sand
- Clear tympanic sound: the dorsal area or zone is enlarged, the flank hollow disappears and even becomes rounded, during gaseous or foamy meteorism,
- Tympanic or rather metallic sound, described as a ringing, when the abomasum moves to the left, with the presence of an ovoid area situated in the middle of the abdomen.

Succussion

Succussion can be performed in two ways.

A hand moved to the left strikes; the clinician, with the hand placed flat on the right flank, looks for the waves caused by this percussion when the contents are very liquid.

More commonly, succussion is performed by the practitioner alone through vigorous movements of the flank.

Auscultation

This is performed using a stethoscope; the back is turned towards the animal's tail and the left hand is placed on the loins.

- Swallowing sound: audible at the 10th intercostal space, it varies depending on the nature of the food bolus passing through:

✓ Solid bolus: "bubbling" sound

✓ Liquid bolus: "cascading" sound

- Rumination sound: produced by the rumen, also at the 10th intercostal space; the sound resembles a loud "gurgling" followed by a dull rumbling
- Sound of rumen rumen : it can be heard in the hollow of the flank, the sound of a waterfall drawing nearer and then receding
- Crackling sounds: these suggest fermentation and correspond to gas bubbles bursting at the surface of the ruminal contents.

The frequency is 7 to 12 every 5 minutes, but in practice, 2 to 3 contractions every 2 minutes indicate good ruminal motility.

Furthermore, these fairly strong contractions, which are more frequent after the ingestion of roughage, are altered in strength and number during digestive disorders.

In a physiological state, these are crackling sounds that become sloshing noises when the rumen is empty or filled with fluid. Rumbling or bubbling sounds are heard in cases of vagus nerve lesions.

Further investigations

- ***Rumen fluid sampling***: using an oesophageal probe and a vacuum pump, but with simultaneous collection of saliva with high buffering capacity

- ***Transrectal examination***: allows palpation of the dorsal area of the rumen and determination of the contents (paste-like, liquid) as well as the degree of distension

- ***Rumen puncture***

For diagnostic purposes: the aim is to collect a sample of ruminal fluid for biochemical and bacteriological examination. The puncture is performed in the flank, one hand's breadth forward of the flank, using a 22G needle fitted with a syringe. After aspiration, the syringe is

separated from the needle before being withdrawn to prevent any contamination by blood when passing through the parietal muscles. The fluid obtained is greenish-grey to greenish-brown in colour, slightly viscous, with an aromatic odour, and a pH value between 5.5 and 7; it contains predominantly Gram-negative bacteria and protozoa.

Curative procedure**:** the aim of the puncture in this case is to evacuate the gas accumulated in the dorsal sac of the rumen during meteorism. The trocar (metal or screw-type) is inserted at the apex of the dome created by the dilation of the dorsal sac of the rumen following a skin incision aimed at the right elbow. The trocar is left in place until the symptoms subside.

- When there is foamy meteorism, treatment then consists of a gastrotomy and the administration of anti-foaming agents

Examination of the omasum

A. General information

The omasum is the [third]pre-stomach of ruminants. It follows the reticulum and precedes the abomasum. It is spherical in shape. With a capacity of approximately 10 litres, this organ, whose walls are composed of fine lamellae that have given it its name, forms a transition zone between the rumen and the reticulum. It allows the absorption of certain nutrients and returns food that is insufficiently
fermented towards the reticulum, where digestion begins through fermentation, and the abomasum, where digestion is essentially enzymatic.

Thanks to its blades, which are spaced at precise intervals, the omasum acts as a filter: large strands of grass cannot pass through. Only particles less than 2 mm long can pass through the omasum: it regulates digestive transit and prepares the cow’s feed for the actual digestion that will take place in the abomasum.

In the omasum, the cow absorbs certain substances contained in the grass ‘slurry’ and microorganisms: water, sodium, phosphorus and other volatile substances. Sodium and phosphorus are reabsorbed into the bloodstream and return to the rumen via saliva. Once the food has fermented sufficiently, it passes into the abomasum.

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The omasum is not a vital organ; it is absent in pseudo-ruminants. In fact, it is absent in camels, llamas and alpacas.

Figure 23: Omas

B. Area of examination

It is almost entirely separated from the right lateral wall by the diaphragm and to a lesser extent by the lung and liver; it is **situated deep within the body**. It is therefore only **accessible** in its **posterior part** (where the blades are located), a hand's breadth from the shoulder between the **7th** and **9th ribs**.

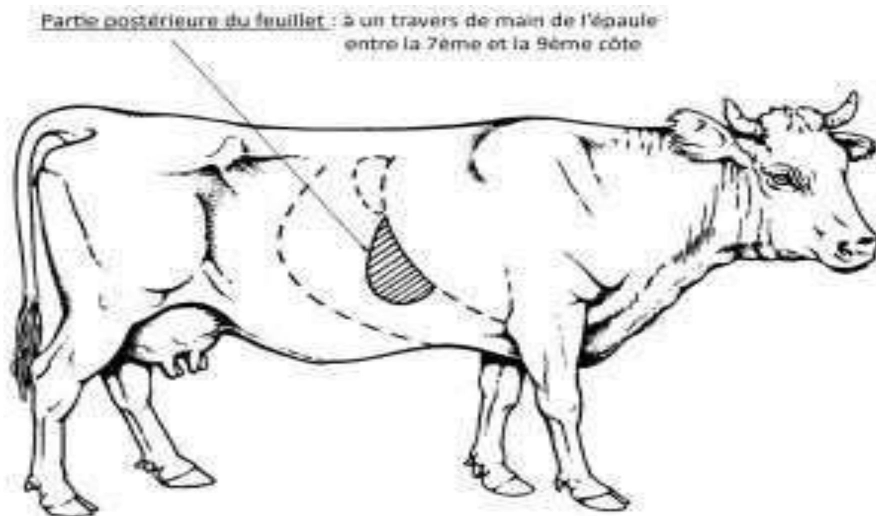

Figure 24: Area of exploration of the pleura (adapted from 'The Clinical Examination of Cattle', Rosenberger, 1979)

Inspection

This provides no information.

Palpation–pressure

Palpation with pressure using the phalangeal joints (1 and 2) or with the fist (succussion) allows, in rare cases, for the detection of a **possible increase** in the organ's **volume**, and above all for the detection of **painful reactions**.In addition, rebound tenderness associated with the organ's movement may be observed when the organ is hard, e.g. atrophy of the omentum, digestive atony (paralysis)…..

Palpation of the organ is possible following a right paravertebral laparotomy

Percussion

This is performed in the intercostal spaces of the projection area of the leaflet and generally produces a dull sound.

A **complaint** is sometimes noted when there is **indigestion** of the leaflet.
The dullness becomes more intense and covers a larger area when the organ is hypertrophied, and disappears when it is retracted (smaller).

Auscultation

The sounds of the leaflet are **faint**, **crackling**, **almost continuous** and difficult to perceive (synchronous with the sounds of the mesentery) and may be confused with those of the rumen.

In cases of obstruction of the reticulo-omasal orifice, a liquid sound is heard.
The functional symptoms of epiglottic indigestion are often **secondary** and **chronic**:

- mucus-coated faecal pellets
- sequelae of traumatic reticulitis with lesions of the vagus nerve

1.3.3.5. Puncture

This is performed using a long needle (20 cm) inserted 15 cm into the intercostal space at the level of the shoulder joint. The needle performs irregular rotational movements, which are absent in cases of leaflet paresis.

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Abomasum

A. General

The abomasum is comparable to the stomach of monogastric animals; **its mucosa is secretory:** it synthesises gastric juice containing water, hydrochloric acid and pepsin (it is the chemical stomach of ruminants).

The abomasum is pear-shaped, arranged longitudinally, to the right of the rumen (20 cm in cattle, 2 cm in sheep, 2–4 cm in goats). It is lined by a peptic mucosa. This is thicker in the pyloric region than in the fundic region.

In calves, the abomasum is the most developed of the four chambers; it occupies a large part of the lower abdomen, from the hypochondrium to the entrance to the pelvis.In adults, its volume represents **one-ninth** of that of the rumen. Its projection varies according to the animal's age and physiological state; it is pushed forward towards the front at the end of gestation.

B. Projection area

The **projection** area is situated on **the right**, **posterior** to **the xiphoid process**, ventrally **and caudally** to **the 11th intercostal space**. The **exploration** area is therefore **between** the **costal** margin and the **abdominal wall**, **but this area is difficult to explore**.In adults, it rarely extends beyond the level of the 3rd lumbar vertebra. Anteriorly, it touches the omentum and partially infiltrates beneath it and beneath the anterior cul-de-sac of the rumen; it crosses the midline from left to right at the level of the umbilicus, encircling the omentum.The pyloric portion then forms an L-shaped curve before continuing into the dorsal region of the hypochondrium, via the duodenum.

In the case of a disorder (simple dilation of the gallbladder), where there is functional stenosis, the organ tends to expand at its posterior end.In the event of pathology, displacement to the left, following its enlargement due to gas and fluids, it migrates in both directions, either downwards and upwards, or to the right along the flank between the abdominal wall and the intestines. This condition can lead to a very serious torsion of the organ for the animal.

Inspection

Stand behind the animal and observe the xiphoid region: the following is apparent:

- A forward curvature of the thoraco-abdominal profile, more or less pronounced in cases of organ **overload** (due to undigested roughage) or rumen meteorism in a calf, or in the case of **functional** or mechanical **stenosis** in an older animal.
- A very distinct asymmetry in the contour of the abdomen; with displacement of the abomasum, the deformation extends further caudally and dorsally
- A prominent profile on the left side appears in the case of a leftward displacement of the abomasum, which may slip beyond the hypochondrium; its apex may reach the anterior part of the flank hollow.

Note:

In small ruminants consuming **concentrate**, **there may be** abomasal **atony** with **gas accumulation**, **inertia and displacement to the left**, **without torsion.** As this displacement does not impede digestive transit, **there is no occlusion, but chronic** indigestion and **ketosis** are then the most significant **warning signs**.

Palpation

This is possible in calves when the rumen is full. It allows the consistency of its contents to be assessed in cases of indigestion (it may be possible to feel undigested casein lumps or foreign bodies).
In adults, palpation is difficult due to a hard, thick abdominal wall, except in cases of gastritis or gastric ulcers, when tenderness on palpation and pressure on the projection point is evident.
It reveals:

- A crackling sound in the region between the xiphoid process and the umbilicus, when it is silted up (deposit at its base).
- A rebound of the organ when it is hardened (due to a tumour or significant sanding) during palpation, pressure or percussion (using the fist).
- When displaced to the left, shaking the flank area behind the left hypochondrium produces a liquid sound.

Palpation can be performed rectally during rightward displacement (appearing as a distended balloon in the dorsal quarter of the abdominal cavity) and, in more advanced cases, it sometimes occupies half of the abdominal cavity down to the pelvis. In left-sided displacement, the apex of the organ cannot be reached by this route unless one of its extremities reaches the anterior angle of the flank hollow.

Direct palpation is possible via a parotidectomy

Percussion

It provides no details regarding the contours of a normal abomasum. Percussion of the abomasum's projection area produces a sub-tympanic to sub-mat sound depending on the degree of filling.

When displaced to the left, it often contains gas; percussion of an oval-shaped area located at mid-abdomen, bounded anteriorly by the caudal edge of the respiratory field and extending posteriorly beyond the hypochondrium, produces a tympanic sound where a dull sound would normally be heard (siterumenal). In the case of **ulcers** or **inflammation**, percussion may be **painful**.

Auscultation

The sounds heard during auscultation of the abomasum are not clearly defined; they lie between the crackles of the pleura and intestinal borborygmi. Auscultation of the abomasum in its physiological position is of no value. However, it is essential for diagnosing displacement of the abomasum.
Percussion auscultation is performed on either side of a line joining the tip of the elbow to the tip of the hip, over an area 20 cm in diameter centred on the lower ribs (corresponding to the pocket of pressurised gas contained within the organ).

In cases of digestive disorders, the following may be observed:

- the sounds emitted by the rumen are heard only at the hollow of the flank. Silence prevails in front. **In the case of a left-sided displacement of the abomasum.**
- A characteristic, pathognomonic tinkling sound (a metallic sound associated with tension in the abomasum wall) is noted in cases of displacement, at the onset of the disease, during percussion auscultation.These ringing sounds can also be heard by tapping gently, using a sleeve, a plethysmographic hammer, very close to the stethoscope's chest piece, or with the fingertips.

Confirmation of displacement can be achieved by a puncture in **the lower flank**, halfway between the hypochondrium and the stifle, using the same type of needle as for the rumen. Confirmation of displacement can also be achieved by **ultrasound**, as the appearance of the abomasum is distinguishable from that of the rumen. If, in addition to displacement, there is **torsion**, **signs of obstruction** may of course be present.

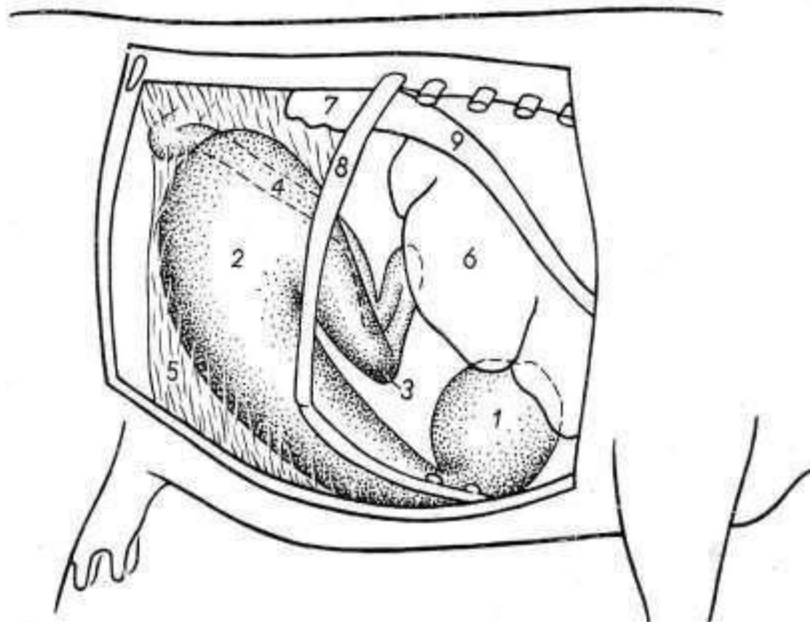

Figure 26: Schematic representation of the anatomical position of the abomasum during dilatation on the right.

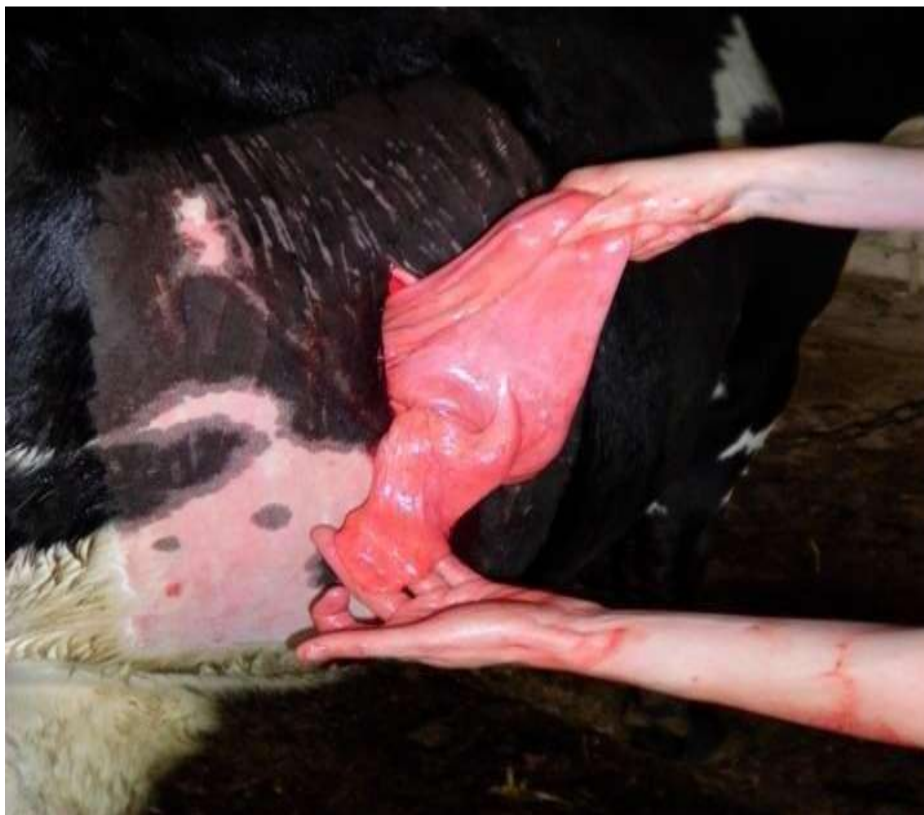

Figure 27: Surgical treatment of abomasal displacement

Puncture

In adults, the abomasum in its normal position is punctured along the linea alba, approximately halfway between the umbilicus and the xiphoid process. In cases of displacement, the puncture is performed in the lower half of the tympanic percussion area. Between the distal ends of the 10th and 11th or 11th and 12th ribs. Fluid is aspirated using a needle 4 to 8 cm in length.

In young calves, the sample is taken from the abomasal fluid (aspirated using a tube 6–8 mm in diameter and 120 cm long).The catheter is inserted up to the middle of the oesophagus; the oesophageal duct is then closed by pouring 100 to 200 ml of milk into it. As soon as the animal swallows, the catheter follows the duct to the abomasum.

* Physiologically, the juice is clearer than gastric juice, with a pH of between 2 and 4 and a sour odour.
* In pathological conditions, the pH is altered:
  - ✓ It is higher (between 5 and 7) when mixed with blood (following severe torsion) or bile, or in cases of chronic gastritis.
  - ✓ It is more acidic (1.8 to 2.5) and has a milky appearance (grey-green) in cases of left-sided displacement.

1.3.4.6 Other investigations

- Laparoscopy: to confirm a shift to the left or right via a small incision for the insertion of the endoscope (location: between the last rib and the transverse process of the lumbar vertebrae).
- Exploratory laparotomy: performed on a standing animal, on the left or right depending on the displacement, for palpation (to assess the position, consistency of the wall and contents, tenderness and any adhesions: 10 cm incision in the flank)

- **Examination of faeces**

✓ A soft, paste-like consistency is observed when moving the faeces to the left and right without twisting, with a finely ground appearance.

✓ A muddy consistency due to the presence of conglomerates the size of a hazelnut to a walnut (undigested) and a lot of mucus, in cases of chronic gastritis; brown or black in colour, with an unpleasant odour in cases of ulcers at the mucosal level.

✓ Eggs of gastrointestinal strongyles may be detected in the collected stool.

Examination of the intestines

A. General

The intestine is divided into two parts:

✓ **The small intestine**: It is very long, 40 to 45 m / 70 L in cattle.

The three sections of the small intestine are: the duodenum, the jejunum and the ileum.

*The duodenum (0.6 to 1.2 m) with its duodenal anastomosis, which receives bile and pancreatic secretions –

*The jejunum-ileum complex (17.5 to 34.0 m)

- Its structure is identical to that of monogastric mammals.
- The mechanisms of digestion and absorption in the small intestine are the same as in monogastric animals

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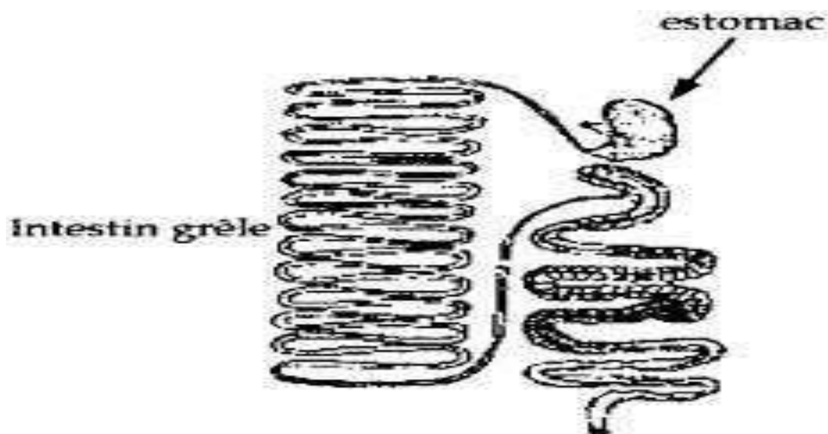

Figure 28: Small intestine

- ✓ **Large intestine**: 10 m (30 L in cattle); it does not secrete digestive juices.

The large intestine consists of:

*Cecum 0.9 m (10 L in cattle). It has a cylindrical and slightly sigmoid shape. Its diameter is approximately 10 cm. It connects to the ascending colon.

*Colon: it is always visible from the flank. It is situated medially to the descending duodenum. The loops of the colon are easily distinguished from those of the small intestine by their gaseous contents.

*Rectum, continuing the canal

The entire small and large intestine measures approximately 50 m in adult cattle.

- Weak microbial digestion
- Site of water absorption and reabsorption

Figure 29: **Intestine of an adult bovine**

The various intestinal segments (duodenum, jejuno-ileum, caecum, colon and rectum) cannot be distinguished from one another. The main aim of the clinical examination will therefore be to look for any changes in their contents.

The consistency of the contents is not the same throughout its length; it is fairly liquid in the anterior part and thicker in the caudal part.

Disorders affecting the intestine may have various causes.
Inflammatory (enteritis) manifesting as diarrhoea; changes in faeces (intussusception, volvulus, torsion) and disruption of food passage, consequently affecting the rumen or abomasum. The most common disorders appear to be displacement to the right or left of the caecum, linked to a modernisation of the diet (more energy-dense and containing less roughage).

B. Topography

The intestines occupy two-thirds of the right half of the abdominal cavity; they are displaced to the right beyond the midline depending on the degree of rumen filling and towards the ventral abdominal wall during gestation.

The duodenum is attached to the parietal layer of the greater omentum and ascends towards the flank.

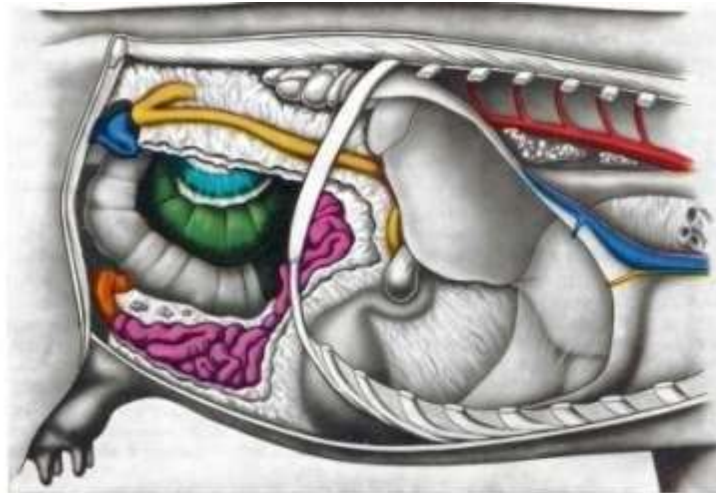

Figure 30: Topography of the intestines, liver and abomasum in cattle (after removal of part of the diaphragm and the greater omentum, Rosenberger). Yellow = duodenum; purple = jejunum; brown = ileum; green = intestinal convolutions (spiral colon); blue = large intestine; grey = caecum, abomasum and liver.

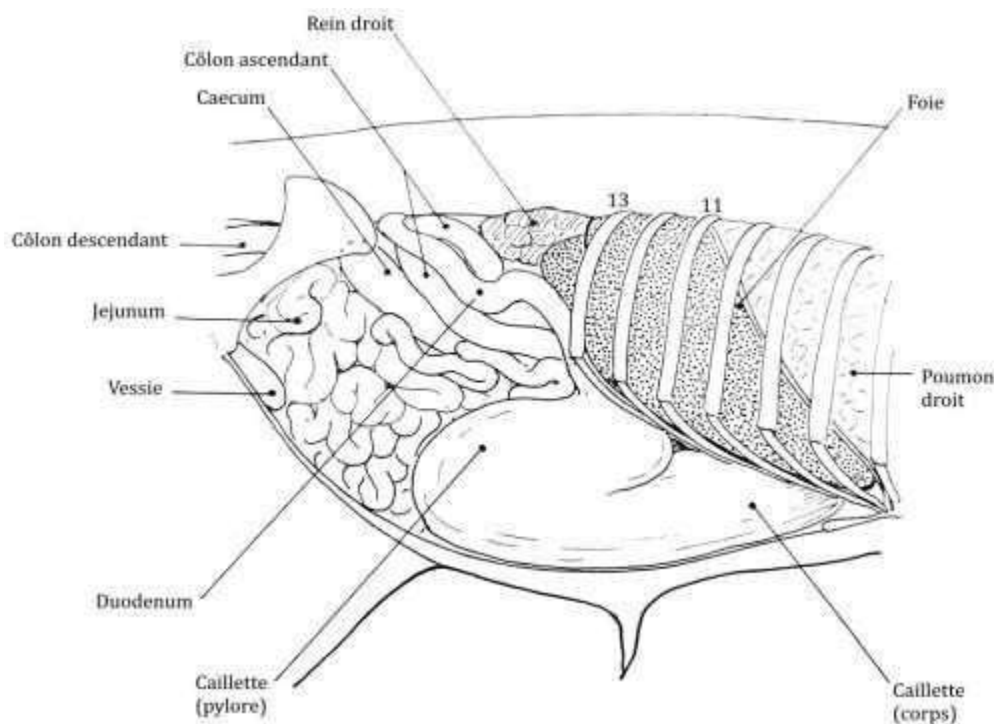

Figure 31: The intestines

1.3.5.1 Inspection

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This is carried out on the right-hand rear quarter.

- **Inspection of the animal's right flank**
  - ✓ Tension of the flank hollow (concavity or convexity).
  - ✓ The right abdominal profile, sloping from the flank to the fat fold.

A displacement of the right hypochondrium and distension of the adjacent abdominal wall may be noted in cases of:

- o Intestinal distension.
- o Fluid accumulation.
- o Torsion of the caecum, the spiral colon, or the small intestine

The caecum, distended and affected by torsion, appears as a cylindrical or spiral bulge deforming the right flank.

- **Inspection of the anus, the underside of the tail and the ischial tubercles**

Information on the nature and consistency of faeces.

- **Inspection of droppings**

Observe the ground behind the animal.

Palpation/Pressure

The techniques applied to the right flank are of little value, except in the diagnosis of dilation with or without torsion of the caecum.

Palpation of the right abdominal wall is performed using the fist along the entire length of the right flank. It allows:

*assess the tension of the abdominal wall.

*to check for tenderness or pain.

*Less conclusive than rectal palpation.

The abdominal wall should be soft and the animal should not show any signs of pain.

Percussion

Percussion of the right abdominal wall is performed with the fist or a heavy hammer, particularly at the level of the right flank.

The sound produced varies:

- Tympanic sound in the upper third of the right flank.
- Dullness in the lower two-thirds.
- A tympanic sound in the ventral region or a dull sound in the dorsal region may be explained by an abnormality in the position or filling of the intestines: torsion of the caecum or abomasum.

The boundary between these two zones is situated higher in animals in late gestation than in cows in early gestation or non-pregnant cows. Percussion can also trigger pain in cases of acute intestinal disorders.

Succussion

Succussion of the right flank is performed in the same way as that of the left flank. It is carried out by placing the hands on either side of the abdomen to mobilise the contents of the abdominal cavity with up-and-down movements.

It helps to assess the flexibility of the abdominal wall and the consistency of the intestinal contents. It is performed behind the area where the caecum is examined, taking care to protect the mammary vein, using the fist in the posterior ventral region. In physiological conditions, the following are noted:

- ✓ Absence of fluid content.
- ✓ Absence of a rebound tenderness, which would indicate induration of the intestinal loops.
- ✓ In cases of diarrhoea, a distinct liquid sound is heard.

1.3.5.5 Auscultation

- ➢ Auscultation area

In adults, the area of auscultation is located on the right side of the abdomen, in the posterior half. In calves, it extends across the entire right flank as well as the caudo-dorsal part of the right flank.

Auscultation of the intestines allows one to hear borborygmi or even possibly trigger a 'ping' sound when the caecum or colon is dilated.

- Borborygmi

This is the sound produced by the movement of gas and fluid in the intestine. Their frequency and intensity may increase during diarrhoea, for example, but there is no standard value and the assessment will be purely qualitative.

- A 'ping' should be auscultated in the following cases:
- ✓ Simple meteorism
- ✓ Dilation of the caecum (distinguished from the appendix by their position)
- ✓ Pneumoperitoneum
- ✓ A rectal or caecal 'ping' can be heard just below the transverse processes of the lumbar vertebrae. Air in the uterus is detectable by transrectal palpation
- ✓ A pneumoperitoneum causes audible 'Pings' along the dorsal part of the abdominal cavity. This is due either to the accumulation of gas in the sigmoid colon at varying heights or to a displacement of the caecum to the right. It is generally audible between the 10th and 13th ribs.

Auscultation and percussion become significant in cases of inflammation or ascites, revealing gurgling or a metallic sound that may accompany simple flatulence, ileus, a shift of the chyme to the right, dilation of the caecum, or a pneumoperitoneum.

Other examinations

In adult cattle, intestinal puncture at the site where tympanism is most clearly perceived is performed to release trapped gas (using a 12 cm long needle) on the right side for the intestines and on the left when a caecal displacement to that side is suspected.
In calves, cases of rectal atresia may occur; in such cases, a rectal sounding should be performed to locate the site of the atresia.

Transrectal palpation

Transrectal palpation is not a supplementary examination. It must be carried out systematically during the clinical examination, particularly of the digestive system. It allows direct palpation of certain organs in the pelvic and abdominal cavities.

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This is the key part of the examination of the intestines. The hand (covered with a pre-lubricated plastic glove) is inserted in a cone-shaped motion to progress through the contractions of the rectum, then placed flat against the rectal wall.

The examination covers the rectum itself and the caudal intestinal loops.

For the rectum, attention should be paid to the condition of the mucosa, the tension of the wall, and the possible presence of adhesions. In a healthy bovine, the intestinal loops cannot be distinguished individually.

Particularly for the intestines, the following are checked:

- The surface
- The thickness
- The wall tension.
- The contents
- Sensitivity
- Any adhesions.

In physiological conditions: the small intestine, the colon and the caecum:

- Are mobile, soft, fluctuant and indistinguishable.
- If the animal is fat, the outlines of the mesentery and omentum can be seen
- The loops are thin and not dilated.
- The contents are soft and not distended

Other organs accessible by transrectal palpation include: the pelvis and pelvic tract, the medial iliac and iliofemoral lymph nodes, the rumen, the genital tract (vagina, cervix, horns, ovaries), the urinary tract (bladder, caudal pole of the left kidney), and the pulse anterior to the aortic bifurcation. The mesenteric lymph nodes are not palpable under physiological conditions

Faecal examination

Examination of faeces allows assessment of the quantity of faeces present in the rectum, their consistency, colour, odour, the degree of digestion of plant fibres (abnormally large size >2cm), and the presence of abnormal substances such as mucus, fibrin, or more or less digested blood.

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Liver

A. General

The liver is a complex gland; its structure offers the following for examination:

- Capsules: one serous and the other fibrous, superimposed.
- A parenchyma consisting of countless lobules.
- Excretory ducts, blood vessels and nerves.

B. Topography and projection area

It is the largest gland in the body, situated on the right side of the abdominal cavity. It has four lobes: right, left, square and caudate. It has a cystic duct in animals that have a gallbladder

It projects from the right side to the rear of the pulmonary field with a dorsoventral orientation. It is situated beneath the ribs (between the 8th and 13th ribs) and does not normally extend beyond the hypochondrium.

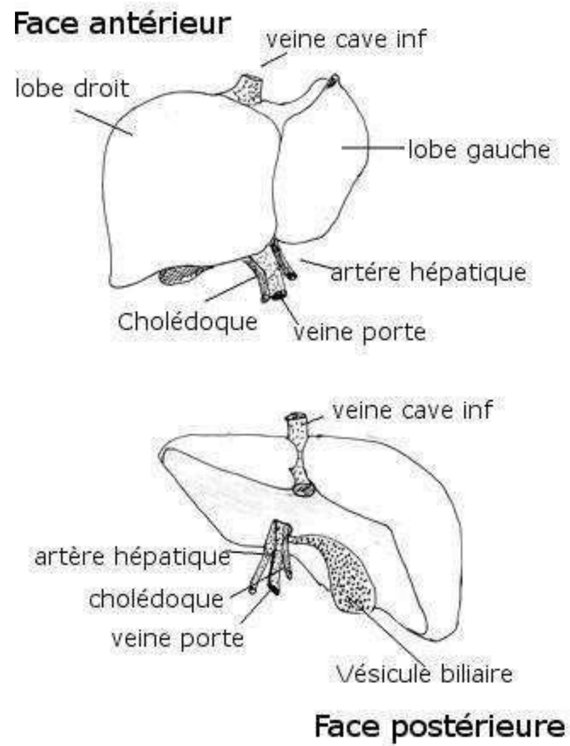

Figure: Anatomy of the liver

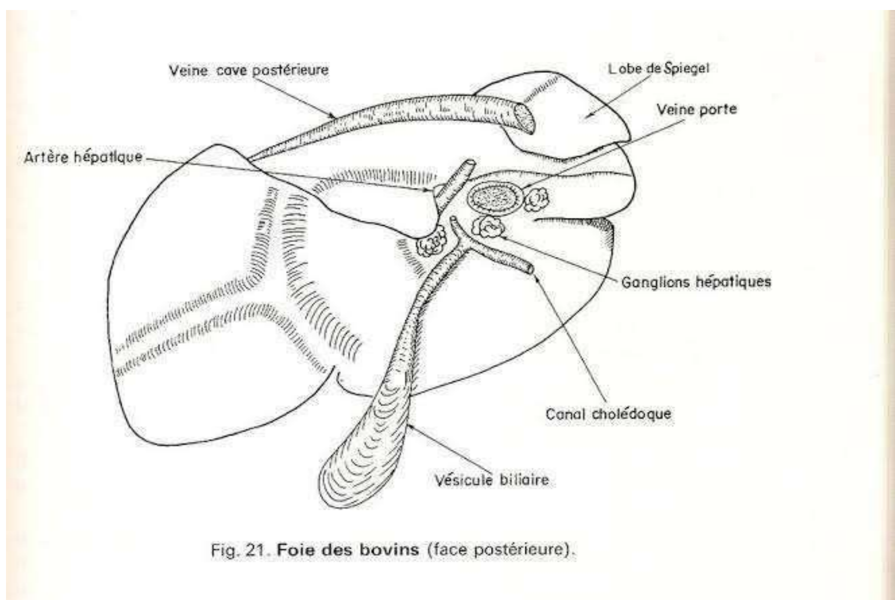

Fig. 21. **Foie des bovins** (face postérieure).

Figure: Posterior view of the bovine liver

In cattle, clinical examination is limited.

Inspection

Inspection of the liver is not carried out. Inspection of the mucous membranes and skin in non-pigmented areas may suggest liver disease in the presence of jaundice, photosensitivity lesions or haemorrhagic lesions.

Palpation

In cases of hepatic hypertrophy, the liver is palpated with the fingers hooked behind the last rib on the right, in the upper part of the flank.

Percussion

The normal percussion sound of the liver (liver sound) is located dorsally in the penultimate and last intercostal spaces, just behind the lung field (lung sound). Tenderness on percussion is rarely noted.

Biopsy

A liver tissue sample is taken to assess diffuse liver lesions.
The puncture is performed using a biopsy needle. The puncture site is located 20 to 30 cm laterally to the spine, in the 11th or 12th right intercostal space. After making an incision in the skin, the needle is inserted blindly through the intercostal muscles into the liver tissue to remove a tissue sample. The biopsy may also be performed following a right laparotomy under direct visual control.

Biological examination

The information provided by biological tests is of major importance for the diagnosis of liver diseases compared to the results of the clinical examination.

Observation and Diagnosis of Liver Diseases in Cattle

1. **Serum Biochemical Analysis**:

   -**AST (SOOT)** and **ALT**: Indicate liver damage, with AST being less specific.

   -**SDH**: Liver-specific; an elevated level indicates severe damage.

   -**γ-GT** and **GLDH**: Useful for distinguishing cholestasis from parenchymal damage.

   -**OCT (Ornithine Carbamoyl Transferase)**: A marker of the liver's detoxifying function.

   -**Serum Bilirubin**: A value >0.5 mg/100 mL is considered abnormal and may indicate liver or haemolytic damage.

   -**Alkaline phosphatase (ALP)**: Indicates abnormalities in bile metabolism, often associated with liver and biliary tract disorders.

   -**Haematocrit**: Helps detect anaemia, often associated with chronic liver disease.

2. **Characteristics of Peritoneal Transudate**:

   -**Simple transudate**: Clear, colourless, non-coagulable fluid, density <1.015 and low in cells.

   -**Pathological exudate**: Cloudy, coloured, coagulable fluid, density >1.013, rich in cells and often containing high levels of protein (indicating inflammation or infection).

3. **Examination by Laparoscopy or Laparotomy**:

   -Allows for the observation of liver abnormalities, adhesions, abnormal fluids or tumours.

   -**Laparoscopy**: Less invasive, but requires experience and suitable equipment.

   -**Laparotomy**: Provides the best opportunity for direct palpation of the abdominal organs, including the liver.

4. **Liver biopsy**:

- In cases of doubt or to confirm a diagnosis, a **liver biopsy** may be performed to analyse liver lesions directly at a cellular level; this is often used to confirm chronic or degenerative liver conditions.

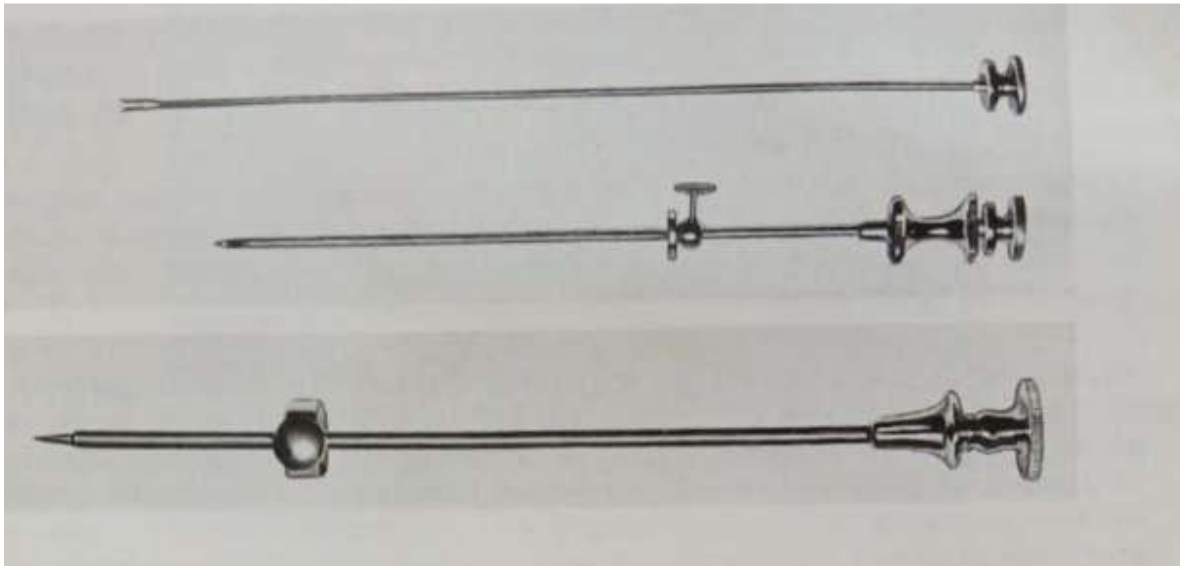

Figure: Collection of liver tissue via biopsy

Top: Vim-Silverman liver biopsy needle with stop ring (knurled screw) and adapted biopsy blade (beside it), modified according to Seifert;below, biopsy/aspiration instrument (5 mm diameter) with straight cutting edge, modified according to Loosmore and Allcroft: on the right, biopsy puncture of a cow in the area of hepatic dullness identified by percussion.

Ultrasound:

Ultrasound is performed at intercostal spaces 10, 11 and 12. This is done to detect the presence of abscesses, visualise the gallbladder or identify other pathologies.

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CONCLUSION

The epidemiological examination of the bovine digestive system requires a holistic approach, incorporating the medical history, careful observation of behaviour, and specific techniques tailored to each organ.

Advances in imaging (ultrasound, CT scan) and molecular biology (PCR, serology) have revolutionised the diagnosis of complex conditions, such as intestinal torsion or pancreatitis. Nevertheless, the traditional clinical examination remains the cornerstone for rapid intervention, particularly in livestock farming settings where technical resources are limited.

Continuing training for practitioners in auscultation, transrectal palpation and the interpretation of test results is essential to reduce morbidity and optimise herd health.