Digestive diseases of ruminants II.
Biochemical disorders of the forestomachs

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## Classification of forestomach disorders

### Localization
- diseases affecting more forestomach compartment (rumen)
- diseases affecting one forestomach

### Course
- **peracute**: a few hours – 2 days
- **acute**: 3-14 days
- **subacute**: 2-4 weeks
- **chronic**: > 4 weeks

### Pathological process
- **Primary**
  - biochemical disorders
- **Secondary**
  - motoric disorders
Diseases of the forestomach I.

- **Biochemical disorders**
  - 1. Rumen overload and dilatation
  - 2. Simple indigestion
  - 3. Ruminal alkalosis
  - 4. Ruminal putrefaction
  - 5. Ruminal acidosis
  - 6. Ruminal tympany (bloat)
Rumen overload and dilatation I.
(dilatatio ruminis ab ingesta)

ETIOLOGY:
suddenly much rough fodder (too tasty, much fibre or unusual)  
“running away”, hunger, lack of drinking, frozen or mouldy feed

PATHOGENESIS:
too much feed: ruminal dilatation and overload

obturated cardia  smooth muscle spasm, pain

improper digestion, mixing  (biochem. disorder)

(-- ) belching, rumination  (++ gas)

compression of the diaphragm and c. vena cava

respiratory and circulatory failure  > asphyxia

prolonged biochem. disorder  > shock
Ruminal overload caused by extremely rough feed and binding rope
**Rumen overload and dilatation II.**

**CLINICAL SIGNS**

peracute (acute) course

- restlessness, colic
- salivation, retching
- dyspnea (labial) breathing, cyanosis, tachycardia
- tense, overfilled abdomen (left flank)
- ruminal statis, compact (thick), sedimented ruminal content
**Rumen overload and dilatation III.**

**DIAGNOSIS**

- **history, clinical signs**

  **Diagnosis:** probing: only few gas and thick content

  **Differential diagnosis:**

  1. **Other biochemical disorders:**
     - triad: feeding history,
     - typical clinical signs,
     - examination of the ruminal fluid

  2. **Diseases with sudden death:**
     - cyanide poisoning, “fog fever”, methemoglobinemia

  3. **Diseases with abdominal distension**
Diseases with abdominal diseases in cattle
(after Garry, 1990)

- a: healthy animal
- b: simple indigestion
- c: acute rumen overload
- d: free-gas bloat
- e: cecal dilatation
- f: Hoflund syndrome (funktional pyloric stenosis)

- rumen
- cecum
- abomasum

- free gas
- rough fodder above the fluid layer
- fluid with finy, dispergated feed particles
Rumen overload and dilatation IV.

**TREATMENT**

1. analgesics, spasmolytics,

2. Emptying the rumen
   • with tube and lavage
   • with rumenotomy (Götze technique)

3. follow-up care:
   dietetic feeding
   (see: simple indigestion)
If you don’t have enough work, construct it for yourself!

Rumenotomy
Simple indigestion I.  
(indigestio simplex ingestae ruminis)

**ETIOLOGY AND PATHOGENESIS:**

feeding abnormalities

- a) quantitative-qualitative
- b) change of the feed disorder of adaptation
- c) technological problems (e.g. lack of cribs or water)
- d) trace elements: (--; ++ Mn, ++ Cu)

- dysfunction of ruminal microorganisms
- slow-down of biochemical processes
  - (- -) ruminal protein and vitamin synthesis, (- -) VFA
- later: metabolic products (NH₃, lactic acids)
Simple indigestion II.

CLINICAL SIGNS

not remarkable, but often appear as a herd problem:

• milk: (--) amount, (--) fat content

• anorexia; weight loss; mild, but long-lasting deterioration

• mild digestive disorders: (--) rumination, (--) rumen motility
  moderated ruminal tympany
  small, firm, doughy rumen

• inactive ruminal fluid (see attached table)
Simple indigestion III.

**Diagnosis:**

Diagnosis: rather by exclusion of other diseases

**Diff. diagnosis:** according to the triad (from biochemical disorders)

- secondary forestomach disorders
- primary motoric disorders
  
  } other organic symptoms

**Treatment and prevention:**

1. **Good quality food:** molasses, sugar beet, hay, grass
2. **Ruminal digestives:** yeast, rumen juice,
   Ruminogen pulv. A.U.V., Diernhofer mixture, rumen extract
   (Stimulex A.U.V.), probiotics (Probios por A.U.V.)
3. **Loosening of the rumen content:** water, mineral oil, salt laxatives (?!)
4. **Elimination of feeding abnormalities**
Ruminal alkalosis and ruminal putrefaction I.
(alkalosis ruminis, putrefactio ruminis)

**RUMINAL ALKALOSIS**

**ETIOLOGY:** (+++) NH$_3$

Pathogenesis: feeding failures
- too much protein
- NPN substances
- alkalic ruminal content,
  NH$_3$ gets into circulation

**RUMINAL PUTREFACTION**

+++) NH$_3$, toxic amines

**putrid bacteria**
- (E. coli, Proteus)
- > from the surroundings
- > overgrowing in the rumen
- same
- + biogenic amines
- damage of other organs
Ruminal alkalosis and ruminal putrefaction II.

**CLINICAL SIGNS**

- **Ruminal alkalosis**
  - general and digestive signs

- **Ruminal putrefaction**
  - same
  - + nervous signs

**Ruminal fluid analysis:**

- moderated abnormalities
- expressed abnormalities
Ruminal alkalosis and ruminal putrefaction III.

**Diagnosis and differential diagnosis:**

according to the triad,
(biochemical disorders, ammonia toxicosis)

**TREATMENT (ruminal putrefaction!):**

1. Controlling of ruminal pH (carbohydrate) vinegar, lactic acid
2. Antihistamines ?, flunixin meglumine ?
3. Antibiotics (neomycin, oxytetracycline) po.
4. Sol. contra alkalosi/putrefact. FoNoVet
5. Parenteral fluid/electrolyte replacement
6. Evacuation of the rumen

**AFTER-CARE:** fresh rumen juice, hay, fermentable carbohydrates, probiotics, Ruminogen pulvis A.U.V. (sugar beet, molasses)
Acute ruminal acidosis I.
(acidosis ruminis acuta)

ETIOLOGY AND PATHOGENESIS:

(+++) carbohydrate  (+++) D-lactic acid
Str. bovis, Lactobacilli  butyric acid
shift of microflora

Local sequelae
1. (--) rumen pH  (butyric acid)
2. Mucosal damage
3. (++) osmotic conc.
4. (++) carbon dioxide conc.

Systemic sequelae
1. metabolic acidosis
2. (--) saliva production (buffer)
3. Parenchym organ degeneration
4. Paralysis of medullar centres

Other consequences:
1. Bacterial toxins  parenchym organ degeneration
2. Biogenic amins  (+++) permeability of vessels, laminitis
3. Ethylene alcohol  toxic signs
Acute ruminal acidosis II.

**CLINICAL SIGNS I.**

Course:
- peracute, acute
- mild, moderate, severe

General signs:
- depression, weakness, recumbency

Basic clinical values
- T: --; P: (++), R: (++)

Signs of dehydration:
- eyes: sunken
- skin: -- elasticity
- mucosal membranes: vascularization, CRT
- + (anuria)
Digestive symptoms:
- *rumen*: firm → loose, → tympanic + atonic
- *feces*: soft, sour, greenish-yellowish, bubbles, blood, grain
- +/- abdominal pain

Central nervous signs:
- stupor, incoordination, impaired sight
- +/- excitement → coma
  + (Kussmaul type dyspnea)

Laboratory examinations:
- *blood*: (++) PCV, metabolic acidosis
- *urine*: (--) pH, negative NAB excretion
- *ruminal fluid*: greenish-yellowish, sour, pH < 5.2
  weak sour cream consistency
  smear: bacteria (Str., Lactobacillus)
Acute lactacidemia

Ruminal fluid: weak sour cream consistency

Grazed housed acidosis simple putrefaction cow cow indigestion

Rosenb Plate6

Grazed cow housed cow acidosis simple indigestion putrefaction
Acute ruminal acidosis IV.

**Diagnosis and differential diagnosis:** according to the triad from biochemical disorders

+ diseases with acute CNS symptoms,
+ diseases with abdominal pain

**Treatment**

1. Correction of acid-base, fluid, and electrolyte imbalance
   in drop infusion + epinephrine, polysaccharide solutions
2. Blocking of lactic acid production and absorption:
   rumen emptying, alkalizers: MgO, Mg(OH)₂, slaked lime (?!)
3. Restoration of ruminal digestion
   yeast, rumen juice, probiotics, hay,
4. Additional treatment
   flunixin meglumine, antihistamines, vitamin B₁ inj.
## Grade and Treatment of Dehydration I.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Dehydration Required Amount of Fluid /day (ml/bwkg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SET (sec)</td>
<td>mild 2-4</td>
</tr>
<tr>
<td>CRT (sec)</td>
<td>3-4 (6%)</td>
</tr>
<tr>
<td>Ht (PCV)</td>
<td>45-50</td>
</tr>
<tr>
<td>TPP (g/dl)</td>
<td>7.0-8.2</td>
</tr>
<tr>
<td>sunken eyes</td>
<td>+</td>
</tr>
<tr>
<td>&quot;shrunken face&quot;</td>
<td></td>
</tr>
</tbody>
</table>


Remark: in slight (< 6%) dehydration the suggested amount of fluid: 20-25 ml/bwkg. Generally used fluid: Ringer solution.
Grade and treatment of dehydration II.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>DEHYDRATION REQUIRED AMOUNT OF</th>
<th>GRADE</th>
<th>FLUID/day (ml/bwkg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SET (sec)</td>
<td>6-10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRT (sec)</td>
<td>5-6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ht (PCV)</td>
<td>50-60 moderate</td>
<td>50-80</td>
<td></td>
</tr>
<tr>
<td>TPP (g/dl)</td>
<td>8,3-9,5 (8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sunken eyes</td>
<td>++</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;shrunken face&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Grade and treatment of dehydration III.

<table>
<thead>
<tr>
<th>PARAMETER DEHYDRATION</th>
<th>REQUIRED AMOUNT OF GRADE FLUID /day (ml/bwkg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SET (sec)</td>
<td>20-25</td>
</tr>
<tr>
<td>CRT (sec)</td>
<td>&gt; 6</td>
</tr>
<tr>
<td>Ht (PCV)</td>
<td>&gt; 60 <strong>severe</strong></td>
</tr>
<tr>
<td>TPP (g/dl)</td>
<td>&gt; 9,5 (&gt;= 10%)</td>
</tr>
<tr>
<td>Sunken eyes</td>
<td>+++</td>
</tr>
<tr>
<td>&quot;sunken face&quot;</td>
<td></td>
</tr>
</tbody>
</table>

**SET**: skin elasticity test, **CRT**: capillary refill time, **PCV**: packed cell volume, **TPP**: total plasma protein.
Classification of ruminal tympany

(+++) gas production  →  Ruminal tympany  ←  +/- gas production

PRIMARY

Free gas bloat  Frothy bloat

SECONDARY

mechanical hinderness

(biochemical disorders) > esoph. obt.   > RPT
> esoph compr.          > Hoflund syndr.
> obturation of           > atropin poison.
  forestomach     > tetanus
    openings

inhibited fore-stomach motorics
### Primary acute tympany 1.

#### ETIOLOGY AND PATHOGENESIS

<table>
<thead>
<tr>
<th>FREE GAS BLOAT</th>
<th>FROTHY BLOAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. (++) gas production</td>
<td>1. (++) gas + foam production</td>
</tr>
<tr>
<td>too much grain, low pH,</td>
<td>Leguminosae, low pH, cold</td>
</tr>
<tr>
<td>(--) adaptation of micro flora</td>
<td>feed, predisposition, ++ Str. bovis</td>
</tr>
<tr>
<td>2. blocked belching</td>
<td>2. lack of belching</td>
</tr>
<tr>
<td>(mechanical, reflectoric)</td>
<td>(no stimulus)</td>
</tr>
<tr>
<td>3. prohibited ruminal movements</td>
<td></td>
</tr>
<tr>
<td><strong>rumen dilatation</strong>, smooth muscle spasm, abdominal pain</td>
<td></td>
</tr>
<tr>
<td>compression of the diaphragm, lungs and caudal v. cava</td>
<td></td>
</tr>
<tr>
<td>acute respiratory and circulatory failure</td>
<td></td>
</tr>
<tr>
<td>+ (absorption of CO$_2$, H$_2$S)</td>
<td></td>
</tr>
<tr>
<td>asphyxia, shock</td>
<td></td>
</tr>
<tr>
<td>CLINICAL SIGNS</td>
<td>FREE GAS BLOAT</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td><strong>General signs</strong></td>
<td>++</td>
</tr>
<tr>
<td>(restlessness)</td>
<td></td>
</tr>
<tr>
<td><strong>Basic clinical values</strong></td>
<td>++</td>
</tr>
<tr>
<td>(respiratory/pulse rate)</td>
<td></td>
</tr>
<tr>
<td><strong>Digestive symptoms</strong></td>
<td></td>
</tr>
<tr>
<td>eructation</td>
<td>stops from beginning</td>
</tr>
<tr>
<td>rumen volume</td>
<td>+++</td>
</tr>
<tr>
<td>auscultation</td>
<td>crackles, crepitation</td>
</tr>
<tr>
<td>palpation</td>
<td>tense</td>
</tr>
<tr>
<td>separation</td>
<td>separated</td>
</tr>
<tr>
<td>percussion</td>
<td>upper third</td>
</tr>
<tr>
<td><strong>Diagnostic probing</strong></td>
<td>tympanic</td>
</tr>
<tr>
<td></td>
<td>much gas</td>
</tr>
<tr>
<td></td>
<td>successful</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Frothy bloat
Free-gas bloat  Frothy bloat
### Primary acute tympany III.

<table>
<thead>
<tr>
<th></th>
<th>FREE GAS BLOAT</th>
<th>FROTHY BLOAT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Course</strong></td>
<td>rapid</td>
<td>rapid</td>
</tr>
<tr>
<td><strong>Outcome</strong></td>
<td>favourable</td>
<td>less favourable</td>
</tr>
</tbody>
</table>

**Diagnosis:**
- > feeding history, clinical signs
- > diagnostic probing (gas, ruminal fluid)

**Differential diagnosis:**
- two types of primary acute tympany
- forms of secondary tympany (meteorismus)
- other biochemical disorders (going along with bloat)
- diseases with abdominal distension
- animals on pasture: poisonings, rabies, tetanus
- diseases with sudden death
What is your diagnosis?

- Free-gas bloat
- Frothy bloat
- Hoflund syndrome, posterior functional stenosis
- Hydroallantois

[Images of cows with diagnoses indicated]
Primary acute tympany IV.

TREATMENT

FREE GAS BLOAT
1. removal of the gas: stomach tube, trocarization
2. elimination of the cause

FROATHY BLOAT
1. removal of rumen content: tube, probang, antifoaming agents
2. elimination of the cause
3. after-care rumen juice, hay

CONTROL AND PREVENTION
• adaptation, avoiding etiological factors
• enough therapeutic instruments, “client education” (measures)
• in some countries: surfactants onto skin, pasture, water (e.g. vegetable oil, poloxalane, alcohol ethoxylates)
• sustained - release techniques (capsule in the rumen)
• monensin: polyether ionofor antibiotic
Antifoaming drugs used against frothy bloat

- **Atympan A.U.V.**
  - timol, formaldehyde, ethylene alcohol, antifoaming agent

- **Bloat remedy A.U.V.**
  - symethicone

- **Tympasol A.U.V.**
  - symethicone, methyl cellulose, peppermint oil, benzyl alcohol, benzoate derivates

- **Traditional, „home-made” mixture**
  - 200 ml ethylene alcohol, cooking oil, methyl cellulose, and water mixed and given in 5 liter water
Treatment of frothy bloat
with the Kaltenböck probang I.
Treatment of frothy bloat with the Kaltenböck probang II.
Thank you for your attention.