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Veterinary LiFE cattle

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BASED ON EVIDENCE

The correct and early diagnostics of BRD as a foundation of effective treatment

Stabilization of the rumen pH is the key for safe transition period

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EDITORIAL PAGE

Dear Readers!

Ahead of us is a period full of challenges, intense work and the necessary commitment.

For many years, autumn and winter have been associated with an increase in the incidence of respiratory tract infections in animals. Supporting the calves especially during this period, is crucial for their later performance and the gains they will achieve during the rearing period, what is strictly related to the economics of the farm. We are becoming more and more aware of the essence appropriate prevention and management of the herd, it is also worth constantly expanding your knowledge - therefore, the latest issue of "Veterinary life" is mainly devoted to issues associated with the occurrence of respiratory infections. Dr Katarzyna Żarczyńska deals with this topic in the article about the correct and quick diagnosis of BRD. A team of employees of Vet Expert, in collaboration with field veterinarians, also presents infectious and non-infectious risk factors associated with respiratory diseases.

Personally, I recommend the article describing the case of the infection of calves with bacteria C. perfringens and S. typhimurium - issues related to the diagnosis and course of the disease, as well as treatment, may be useful in your field practice.

I invite you to read!!

Anna Rutkowska
Editor-in-chief

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The eye of an expert

The correct and early diagnostics of BRD as a foundation of effective treatment

Katarzyna Żarczyńska, DVM, PhD

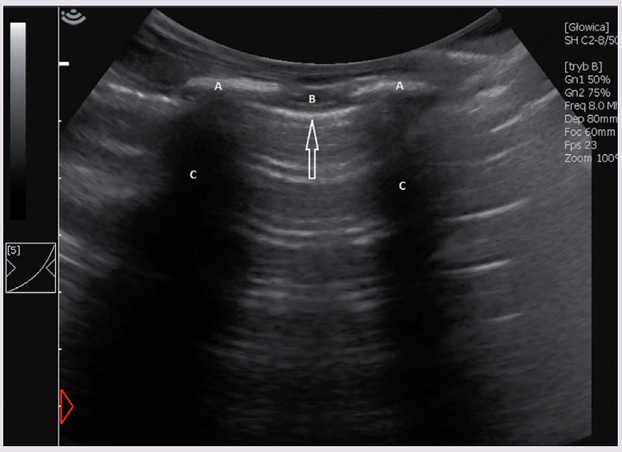
Bovine respiratory disease (BRD) is a multifactorial disease which affects cattle at any age. This syndrome is a result of a complex interaction between the contagious factors (bacteria, viruses), status of the animal's immune system and exterior stressors (weaning, transport, changes in diet and/or living conditions). It is one of the most common diseases of dairy calves which accounts for about 35% of deaths of animals aged from one to five months (Murray et al, 2018). Bovine respiratory disease leads to significant consequences and poses a serious challenge for an effective production and well-being of cows. It is also a cause of economic losses associated with limited growth of animals (Delabouglise et al, 2017).

Assessment of the clinical symptoms of a respiratory tract disease may be performed at the farm in order to diagnose BRD. Calf Respiratory Scoring Chart is one the ways of diagnostics standardization which may be easily applied by herdsmen taking care of calves. The most popular scoring system is based on classification of the rectal temperature, presence of cough and appearance of nasal and ocular discharge as well as scoring of ears position from 0 to 3 (from normal to the most abnormal), and the sum of all the points for each clinical symptom is the final result. The score of five or more indicates a respiratory disease of a calf. Thorax auscultation is also a foundation of the respiratory system evaluation of the ruminants. However, clinical symptoms and auscultation are poorly correlated with lung lesions and posttreatment prognosis (Buczynski et al, 2016, Cuevas-Gomez et al, 2020). Therefore, although these methods may be applied to detect clinical cases of BRD, the subclinical cases of respiratory syndrome may remain undiagnosed.

Thoracic ultrasound is a fast and non-invasive diagnostic and prognostic method which is used to detect lung abnormalities (Ollivett, Buczinski 2016). Besides, ultrasound-based detection of lung lesions is significantly correlated with necropsy results (Baruch et al, 2019). Ultrasound examination shows higher accuracy in case of diagnosing BRD as compared to conventional methods such as auscultation or scoring chart (Buczynski et al, 2014). Besides, in order to be able to perform this examination, extensive training or advanced skills are not required and low variability is observed between the examiners identifying the pathology.

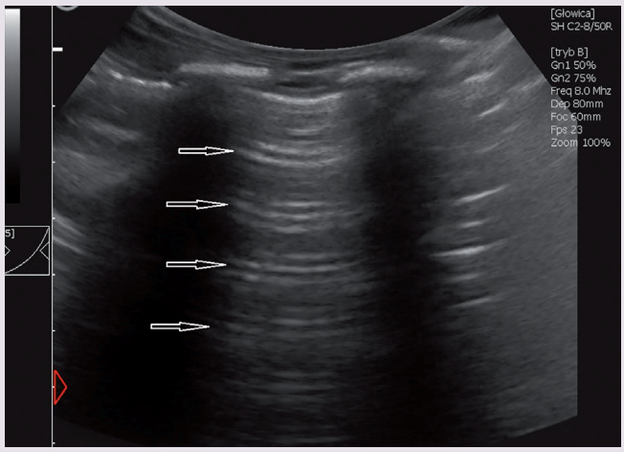
In order to perform the pulmonary ultrasound of the calves, it is enough to use a rectal probe. It is not required to clip hair in the area of thorax in order to achieve a better image. Isopropyl alcohol (70%) is used as a medium for ultrasound transmission and it is applied with a spray bottle. Maximum depth of the ultrasound beam should not exceed 8-10 cm in bigger and 6-8 cm in smaller calves. Both sides of chest should be examined. The probe may be placed in the intercostal space in both planes – perpendicular or parallel to the surface. There are advantages and disadvantages of both of them. In case of a perpendicular placement, it is possible to visualize, along the space and when moving the probe cranially and caudally, the subcostal area which is not possible in case of the parallel placement of the probe. The disadvantage of this technique is that the rectal probe is wider than the intercostal space and in many cases, when moving it along the space and observing the ultrasound image, we obtain the image of ribs instead of the pulmonary tissue. This problem does not exist in case of performing the examination with the probe which is placed in the parallel plane (two ribs and intercostal space are visible all the time). The probe cannot be placed perpendicularly in case of the need to visualize the apical parts of the lungs which are located under the scapula and that is where the initial lesions typical of BRD appear. In this case, only the parallel placement of the probe and its "pressing" under the scapula is useful. The key of precise scanning is a systematic evaluation by moving the probe from the tenth intercostal space and moving it cranially to the first intercostal space in case of the right lung and from the tenth intercostal space to the second intercostal space in case of the left lung. When performing the ultrasound of an animal which shows respiratory abnormalities, it is recommended to scan cranially the whole thorax starting from the tenth intercostal space. **In animals with advanced BRD it is very important to examine the caudal**

Fig. 1.



Normal visualization of the lungs.
Arrow- pleura,
A- rib,
B- intercostal space,
C- rib shadow

Fig. 2.



Correct visualization of the lungs. Arrow – artifacts of A line

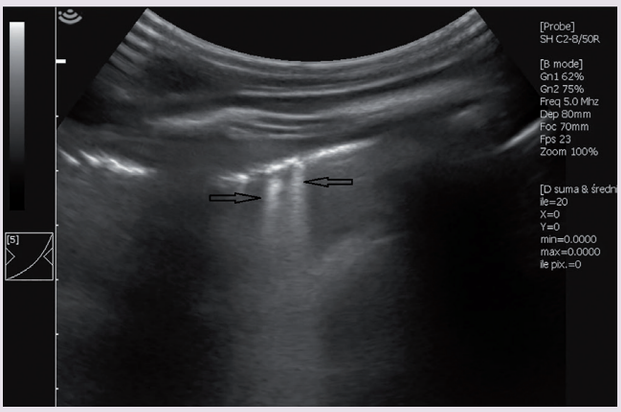
lobe of the right and left lung (6-10th intercostal space), since that is the area where the pulmonary abscesses are located. A different approach may be applied upon a screening examination of a group of calves. Lesions associated with bronchopneumonia may be found in three pulmonary lobes, in particularly in the early phase of disease. At first the lesions appear in the cranial part of the cranial lobe of the right lung, then in the middle lobe of the right lung and the posterior part of the cranial lobe of left lung. In the overall population of the young cattle, bronchitis rarely develops in the caudal lobes of the lungs without at first affecting cranial parts of the lungs. However in this area, focal pulmonary abscesses develop and the clinical experience shows that visualization of abscesses and/or consolidation indicates poor prognosis (Buczinski et al 2014).

Thoracic ultrasound enables to visualize the subcutaneous tissue, the abdominal cavity wall, intercostal muscles, parietal pleura and pulmonary surface (the visceral pleura). The subcutaneous fat and the connective tissue are more echogenic as compared to the muscle tissue. Under the normal conditions the pleural line, which consists of parietal pleura, visceral pleura and some liquid between them, is visible as strongly hyperechogenic, linear streak which separates the structures of thorax from the lung parenchyma. There is only relatively homogenous reflection visible and it does not allow to distinguish any structures and a few artifacts which may be observed in the normal image. The majority of artifacts, whether they are physiological or pathological, originate from the pleural line. The ultrasonographic artifacts may be classified as dynamic and static. The dynamic artifacts include the artefact which is referred to as "lung sliding" or "gliding sign". It appears on the pleural line as a result of the movement of the visceral pleura on the parietal pleura that occurs with the respiration as a consequence of changes in the lung volume and is significantly more visible in the basal than in the apical segments of the lungs. The static artifacts include A-line artifacts – horizontal, hyperechogenic lines which are parallel to the pleural line and are so called: reverberation artifacts – multiple and gradually fading away copies of the pleural line. The distance between them is equal to the distance between the pleural line and the probe. On the other hand, the vertical, hyperechogenic lines in a form of a comet tail are defined as B-line artifacts. They begin on the pleural line and are visible along the whole length of the screen as well as move together with the movements of the visceral pleura. They appear as a result of the presence of some amount of fluid under the visceral pleura (usually in the interalveolar septa) and usually do not coexist with A-line artifacts. Presence of one or two B-line artifacts at one placement of the probe in any site of thorax is considered to be a norm.

Abnormalities which usually accompany the bovine respiratory syndrome and may be detected during ultrasound examination include the accumulation of fluid in the pleural cavity, abscesses or pulmonary consolidation.

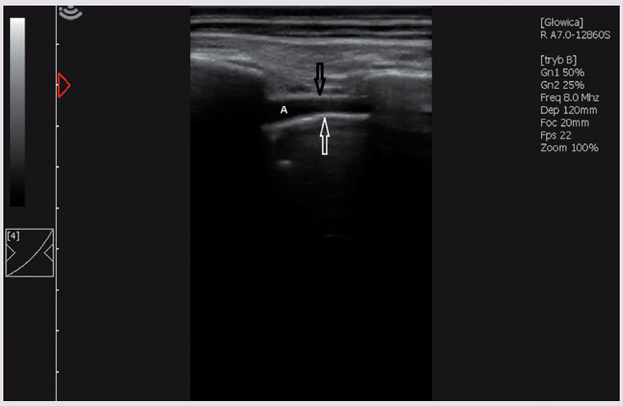
Pneumothorax facilitates performance of thoracic ultrasound, in particular when there is a moderate or high volume of accumulated fluid. In case of the accumulation of fluid in the pleural cavities, the mediastinal fluid, mediastinal vessels, surface of the heart, lungs and diaphragm may be easily visualized. Pneumothorax is visible as an anechoic or echogenic space between the thorax wall, lungs and diaphragm. Echogenicity of pneumothorax is varia-

Fig. 3.



B line artifacts (arrow)

Fig. 4.



Hydrocephalus.
Black arrow – parietal pleura,
white arrow – pulmonary pleura,
A – fluid

ble and depends on the type of fluid and its type. Transudate, a modified transudate and lymph are usually anechoic or hypoechogenic. Blood is usually more echogenic. In case of a chronic pneumothorax, fibrotic structures in a form of linear, irregular, echogenic structures (threads) which undulate in the fluid may be formed. Some amount of fluid separates two types of pleura which allows sometimes to distinguish them (Reef et al, 1991, Flock 2004).

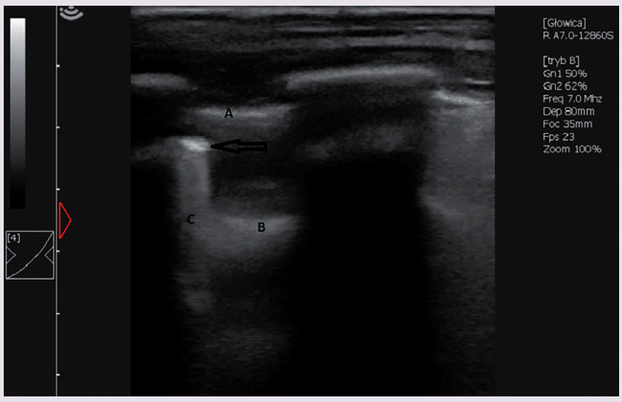
Pulmonary consolidation causing lung airlessness occurs when the air in alveoli is replaced with fluid, cells or cellular exudate, usually without any significant change in the volume of the lung lobe. The lesions may be focal and local and include one lobe or a few lung lobes. The inflammatory lesions may be visualized when they are in a direct contact with the pleura and only such changes may be found on ultrasound examination. It is not however any limitation of the method because almost 100% of clinically significant changes show this location (Tharwat, Oikawa 2011). Small lesions in the lungs (subclinical form) are usually visible in a form of round hypoechogenic zones, from a few milometers to a few centimetres in size, which are accompanied by the "comet tail" artifact (C- line artifacts). These changes are localized in the lung apical parts. Lesions, when gradually developing. appear in deep layers of the parenchyma and the areas of consolidation are usually irregular and have ragged margins. They may be homogenous but more often heterogenous areas are observed (Flock 2004). **Lung airlessness** which is also referred to as hepatization is an anatomical term which may be sometimes used to describe ultrasound images. The ultrasound image of the airless lungs resembles, in terms of echogenicity and echostructure, the liver image, in particular when large bronchi are filled with fluid and are similar to the liver vessels.

Ultrasound diagnostics of the pulmonary lungs is feasible only when the lesion is located close to the pleura. It is not possible to identify abscesses which are localized in deep layers of the pulmonary tissue due to the surrounding air. The classic image of the lung abscess are fluid compartments. The fluid may be anechoic or echogenic. Sometimes a layered structure of the inner of abscess may be seen; less echogenic fluid in the upper part and a cellular deposit of higher echogenicity in the lower part.

The abscess capsule may be smooth or rough and have an uneven surface. The presence of hyperechogenic fibrotic capsule confirms a chronic character of the disease. The abscess margin is however, in many cases, poorly visible as a reduction of echogenicity at the margin of the lesion (Braun et al, 1995).

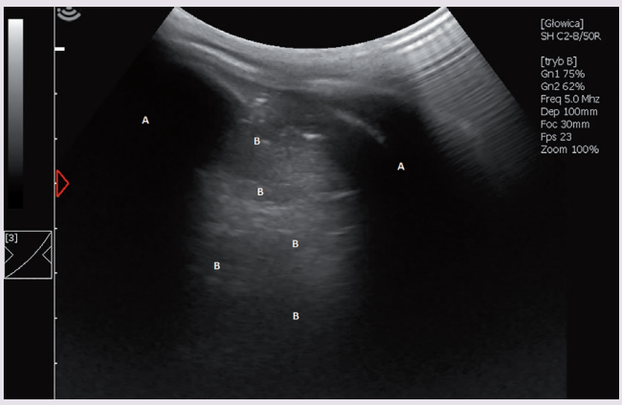
Early and correct diagnostics of bovine respiratory syndrome plays a crucial role for a prudent application of antimicrobials, reduction of the relapse rate and animal mortality rate. However, diagnosis of BRD remains a challenge due to the lack of in vivo "gold standard" of a diagnostic method. The consequence is delayed or incorrect diagnosis of the disease. Type, severity and extension of the lesions which develop in case of BRD may not always be determined based on the clinical examination. It may lead to an incorrect interpretation of respiratory symptoms and ineffective therapy. Subclinical BRD in cattle with pulmonary lesions but without clinical respiratory symptoms may only be detected by ultrasound examination. Additionally, thoracic ultrasound is also a very good technique to assess prognosis and to monitor efficacy of antibiotic therapy.

Fig. 5.



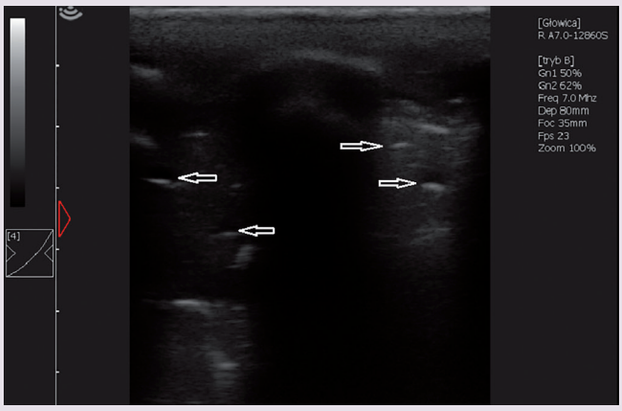
Pathological picture of the lungs.
A – pleura,
B – A line artifacts,
C – C line artifact,
arrow – lung tissue compaction

Fig. 6.



Pathological picture of the lungs – hepatization.
A – rib shadow, airless lungs

Fig. 7.



Pathological picture of the lungs – abscesses (arrow)

Bibliography:

1. *Baruch J., Cernicchiaro N., Cull CA., Lechtenberg KF., Nickell JS., Renter DG. 2019. Performance of multiple diagnostic methods in assessing the progression of bovine respiratory disease in calves challenged with infectious bovine rhinotracheitis virus and Mannheimia haemolytica1. Journal of Animal Science. 97(6):2357-2367.*
2. *Braun U., Fluckiger M., Sicher D., Theil D. 1995. Suppurative pleuropneumonia and a pulmonary abscesses in ram: ultrasonographic and radiographic findings. Schweizer Archiv für Tierheilkunde,137:272-278.*
3. *Buczinski S., Faure C., Jolivet S., Abdallah A. 2016. Evaluation of inter-observer agreement when using a clinical respiratory scoring system in pre-weaned dairy calves. New Zealand Veterinary Journal, 64: 243–247.*
4. *Buczinski S., Forte´ G., Francoz D., Bélanger A-M. 2014. Comparison of thoracic auscultation, clinical score, and ultrasonography as indicators of bovine respiratory disease in preweaned dairy calves. Journal of Veterinary Internal Medicine, 28(1):234-42.*
5. *Cuevas-Gómez I., McGee M., McCabe M., Cormican P., O'Riordan E., McDaneld T., Earley B. 2020. Growth performance and hematological changes of weaned beef calves diagnosed with respiratory disease using respiratory scoring and thoracic ultrasonography. Journal of Animal Science, 98(11):1–11.*
6. *Delabouglise A., James A., Valarcher J-F., Hagglünd S., Raboisson D., Rushton J. 2017. Linking disease epidemiology and livestock productivity: The case of bovine respiratory disease in France. PLOS ONE 12, e0189090.*
7. *Flöck M. 2004. Diagnostic ultrasonography in cattle with thoracic disease. Veterinary Journal, 167:272–280.*
8. *Murray GM, More SJ, Clegg TA, Earley B, O'Neill RG, Johnston D, Gilmore J, Nosov M, McElroy MC, Inzana TJ, Cassidy JP. 2018. Risk factors associated with exposure to bovine respiratory disease pathogens during the peri-weaning period in dairy bull calves. BMC Veterinary Research, 14(1):53.*
9. *Ollivett TL., Buczinski S. 2016. On-farm use of ultrasonography for bovine respiratory disease. Veterinary Clinics of North America: Food Animal Practice, 32(1):19–35.*
10. *Reef VB., Boy MG., Reid CF., Elser A. 1991. Comparison between diagnostic ultrasonography and radiography in the evaluation of horses and cattle with thoracic disease: 56 cases (1984-1985). Journal of the American Veterinary Medical Association. 198:2112-2118.*
11. *Tharwat M., Oikawa S. 2011. Ultrasonographic evaluation of cattle and buffaloes with respiratory disorders. Tropical Animal Health and Production, 43:803–810.*

Pathogenesis of *Clostridium perfringens* and *Salmonella typhimurium* infection in calves – a study case

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Izabela Gwincińska M.Sc. Eng., Vet Tech

Environmental anaerobic bacteria are natural microbes of the gastrointestinal tract of farm animals and people but they also reside in soil. The absolute condition for their excessive growth is tissue ischaemia and reduction of oxyreductive potential (Eh) which lead to conversion of the physiological and saprophytic bacteria in the digestive system into pathogens which pose a threat for health and secrete numerous toxins including the lethal ones.

Clostridium perfringens

Clostridium perfringens is a Gram positive, anaerobic bacillus which secretes endospores. It is quite common in the environment, water, sewage, soil and is a natural component of the human and animal gastrointestinal tract. In practice, we distinguish 5 toxinotypes of *C.perfringens* (A, B, C, D and E) which produce about 16 toxins, the most common are α, β, ε and ι as well as enterotoxin and necrotic enteritis toxin (NetB). Besides, the pathogen also produces extracellular enzymes which facilitate colonization of the intestinal epithelium. Morbidity rate related to this pathogen is not high but the mortality rate oscillates at the level of 100% thus the resulting economic burden or *C.perfringens* is high. In animals with diagnosed haemorrhagic necrotizing enteritis, toxinotype A is almost always isolated and it is a result of physiological presence of *C.perfringens* (type A) in the cattle intestinal microbiome. Therefore when identifying the infection, mainly quantitative and not qualitative methods show diagnostic value – we will always find the pathogen in the gastrointestinal tract so we need to determine the bacterial titre and/or the quantity of the produced toxin. A disease associated with toxinotypes B, C and E are relatively rarely described in cattle, toxinotype D causes enterotoxaemia (neurological symptoms without major damage of the intestines) and toxinotype A induces necrotic and haemorrhagic enteritis.

Causes of the disease

In young calves, *C.perfringens*-related disease affects mainly suckling animals which paradoxically are initially in a good condition. The studies performed in Belgium showed higher susceptibility of Belgian Blue calves to the infection which may be genetically conditioned. Diet plays an important role in pathogenesis of *C.perfringens.* In order to proliferate, the pathogen uses excess of protein and carbohydrates in the feed. Clostridium do not have many genes which are essential for biosynthesis of amino acids and are not able to grow in the environment with a limited supply of them. The correct formulation of ration, increase of fibre content and reduction of protein and easily digestible carbohydrates may limit the risk of bacterial proliferation.

Stress is considered to be a factor which induces many diseases including those related to environmental pathogens. In each case of stress exposure (regrouping, crowding, change of feed, decornization) the intestinal microbiome becomes modified and the proliferation of pathogenic bacteria increases. Intense proliferation of *C. perfringens* on the specific intestinal area leads to degeneration of nerve ganglia, stagnation and as a consequence to necrosis which hinders peristalsis along the whole intestine as well as to a reduced excretion of pathogens and toxins which accelerates the development of disease.

The course of infection

Identification of symptoms is very difficult because these are usually animals in a good condition that become sick and the course of disease is fulminating. However, if the problems with a calf are noticed, it is usually too late to help it. The animal may die within 5 hours. The calves are found with the symptoms of cardiovascular shock in a recumbent position with cold legs. Colic and respiratory failure are more rarely identified, occasionally neurological symptoms, abdominal bloating and diarrhoea are found. In the course of abomasitis related o C.perfirngens, colic and haemorrhagic diarrhoea are observed.

The necropsy shows diffuse or local haemorrhage from a small intestine with a lot of haemorrhagic content, paralysis and intestinal necrosis are visible – in the area of stasis, haemorrhagic lesions are present and they may include the whole small intestine and are usually located in the caecum and ileum (Fig. 1). Mesenteric lymph nodes are enlarged, haemorrhagic lesions are not observed in other organs. In case of abomasitis, the lesions mainly include acute emphysematous and necrotizing haemorrhagic abomasitis with a clear oedema of the lamina propria and the submucosa.

Cellular necrosis and haemorrhage from the villi apex to the crypt base as well as neutrophile and lymphocyte infiltrations are observed in the microscopic examination. In case of a severe necrosis, necrotic villi apexes are visibly separated from the viable tissue which is beneath. These observations indicate that villi are initially damaged in the basal membrane and in the lateral domain of enterocytes. As a result, the lamina propria becomes extensively damaged.

Fig. 1. Post-mortem presentation of a calf infection caused by *Clostridium spp.*:

A – Typical swelling of a dead animal body

B – Hyperaemic and mucous and blood filed intestines

Pathogenesis

In order to colonize the intestinal epithelium, *C.perfringens* uses extracellular enzymes such as sialidases: large exosialidases NanI and NanJ and a smaller, intracellular NanJ. They detach terminal sialic acids from sugar chains of glycoproteins, glycolipids, oligosaccharides, gangliosides and other sialoglycoconjugates causing degradation of mucin – a layer of mucous which protects a delicate intestinal mucous membrane. It results in a direct impact of toxins of *C.perfringens* on the intestinal tissue.

Apart from sialidase, five genes of hyaluronidase (nagH, nagl, nagK and nagL) which code secretion enzymes, are described in the genome of *C.perfringens*. They reduce the viscosity by degradation of hyaluronate which results in the increased permeability of connective tissues and potentially increased spreading of germs and toxins. Besides, hyaluronidase may degrade coatings of hyaluronan cells which enables direct contact between pathogens and the host cellular surface. The final products of degradation are disaccharides which may be used as nutrients by pathogens. Another role of hyaluronidase is to facilitate distribution of toxin α increasing its activity.

C.perfringens also produces collagenases which degrade integrity of tissues and then cause its necrosis – collagen is thus an important component of the connective tissue which is present in the whole body and also constitutes an important element of basal membranes, including the intestinal mucous membrane and epithelium.

In sick calves, a significant growth of bacteria is not observed. However, the increased amount of toxins is found. *Clostridium perfringens*, after getting in touch with intestinal epithelium and in reaction to defence mechanisms, produces an increased amount of toxins which cause necrosis of the intestinal epithelial cells. The earliest histopathological changes include shedding of epithelial cells into the intestinal lumen and hyperaemia of capillary vessels. The pathogen takes advantage of favourable conditions (accumulation of undigested protein and carbohydrates, stress) and starts degradation of mucin with its enzymes. At the same time, it uses compounds which are released in this process (disaccharides, sialic acid) for direct proliferation within the uncovered and unprotected intestinal epithelium. The cellular reaction with the host body increases production of toxins which rapidly damage the mucous membrane and nerve ganglions leading to local necrosis which over time covers larger part of the small intestine. The effect is diffusion of inflammatory cytokines (such as TNF-α) and toxins (e.g. LPS endotoxins from Gram-negative bacteria) from intestines to the systemic circulation which leads to shock and rapid death.

Salmonella typhimurium

It is a Gram-negative, facultative anaerobe causing systemic infection which is similar to typhoid fever. It also causes gastroenteritis in people. There are almost 2000 strains of *Salmonella enterica* known. Ten of them cause diseases in cattle (including S. *thyphimurium*).

The causes of disease:

Pathogens usually attack calves:

- Which are improperly fed with colostrum,
- With inadequate immune status
- With a deficit of competitive bacteria (natural intestinal bacteria) which means that mainly after antibiotic therapy

The cause of infections may be also calf transport which is associated with stress, immunosuppression, crowding, contact with many other animals/people/drinkers etc.

In adult cattle, the most common cause of the infection is stress which induces local drop of immunity in the intestines and exposure to proliferation of pathogens due to the change of microbiome proportion. The key moments are thus: parturition, acidosis, ketosis, postpartum inactivity, increased surrounding temperature, strongly contaminated and moist bedding.

The animals become infected with *Salmonella spp.* by eating a contaminated feed/straw or drinking contaminated water whereas contamination of feed may take place also in the warehouse or in transport. In the course of systemic infection, bacteria are excreted by a sick animal not only with faeces but also with saliva, nasal discharge, urine and milk.

Manure is the largest reservoir of *Salmonella spp* which may survive there up to 4-7 months. Therefore it is important to store it properly before taking to the field. The shaded places with natural declination of the area and high level of moisture should not be fertilized with the manure, in particular from chickens, because it creates conditions under which pathogen may persist for many months.

The course of disease

The most common symptoms of infection include: temperature above 40°C, diarrhoea (yellow, sometimes with addition of blood and mucous), fast dehydration. Death takes place within 24-48 hours from development of symptoms.

In adult cattle, the first symptom is fever (about 40°C), after two days other abnormalities occur: apathy, reduction of appetite, abortions, reduction of milk performance, diarrhoea with addition of blood, mucous and undigested food residues. Recovery takes a long time and often leads to culling due to difficulties in coming back to the previous condition and performance. After recovery adult cattle often become an asymptomatic carrier (shedding of *S. typhimurium* persists 6 months after recovery; for a comparison, in case of *S. Dublin*, shedding occurs throughout the whole life of an animal).

S.typhimurium is a bacterium which is resistant to a wide variety of antibiotics and is difficult to treat since the infection leads to fast dehydration. The key is hydration of animals and replenishment of electrolytes in case of adult cattle which underwent infection, culling (in case of animals with low performance and in poor condition) due to the possibility of transmitting pathogen to small calves and the associated poor prognosis should be considered.

Pathogenesis

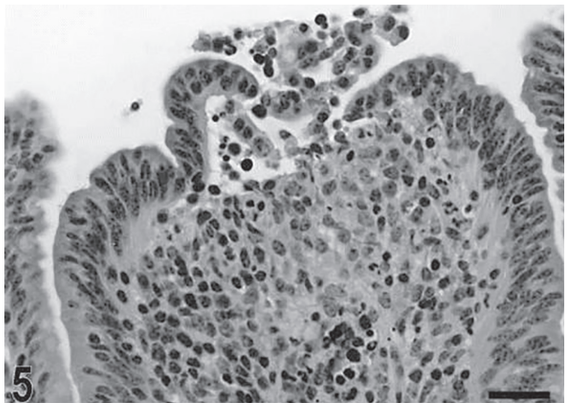
Bacteria *Salmonella spp.* have virulence plasmids which determine their pathogenicity, genes which are related to virulence are also located on cytochromes of Salmonella spp., where they form regions which are called *salmonella pathogenicity* island (ang. SPI). One of them, SPI-1 is present in all the strains of *Salmonella enterica* taxon (*typhimurium* subtype) and is essential to invade intestinal epithelial cells.

SPI-1 codes a secretion system which releases effector proteins from bacteria into cytoplasm of body cells resulting in fast invasion of the line of epithelial cells. Pathogenicity island SPI-2 codes the innate capability of *Salmonella enterica* to survive in the host macrophages. In the first place, the M cells which are located on the surface of Peyer's patches become infected, then the pathogen is phagocytized by macrophages which stimulates the production of neutrophils. It is positively correlated with inflow of water into the intestinal lumen and the increasing accumulation of water over time results in fast dehydration of the body.

The microscopic changes in the intestinal epithelium occur rapidly: intestinal lymphatic villi become shortened within 15 minutes from the infection and after 3 hours, epithelial cells become separated from the villi apex after 3 hours (Fig. 3). Ten hours after the infection, the epithelium which covers villi and the upper part of crypts completely disappears. The first necropsy lesions are noticeable with the naked eye 1 hour after the infection and are characterized by mild inflammation with perivascular infiltration caused by an enhanced release of neutrophils.

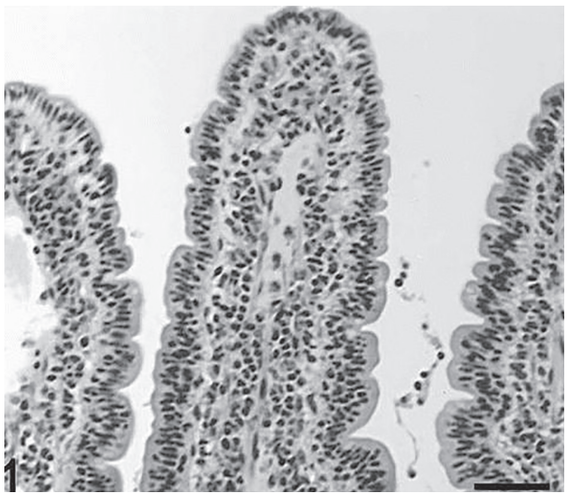
In response to infection, the body starts to produce a large amount of chemokines and cytokines: IL-1, IL-8, IL-18 (GCP)2 – chemotactic protein of granulocytes. Death takes place as a result of fast dehydration, damage of intestinal epithelium by degradation of villi and a strong toxemia. Given the rate at which the changes occur in the intestinal epithelium, it may be hypothesized that it is almost impossible to diagnose a sick calve rapidly enough to help it. In case of *S.typhimurium*, it is usually impossible to diagnose it based on the clinical symptoms and identification of pathogen which caused diarrhoea requires additional tests (including, in the first place, the culture of intestinal content which preferably should be obtained from the intestine which is ligated during the necropsy).

Fig. 2.



The small intestine. Detachment of epithelial cells at the villus apex takes place as early as three hours after the infection (source: 5).

Fig. 3.



Calf intestine. The correct histological image of villi in Peyer's patches (source: 5)

S.typhimurium is especially dangerous not only for animals (it is almost impossible to diagnose it without a death of at least one animal) but also for people – salmonellosis is zoonosis which is a hazard for people's health. Economy of herd infected with this pathogen deteriorates due to the fact that adult animals which suffered from the infection remain asymptomatic carriers and may at any time (for a few months from the end of disease) infect young animals which due to stress, are immunosuppressed.

The study case

A farmer bought 20 bulls aged 2 months of life for a farm specialized in calf rearing. The country of bulls origin was Lithuania. Calves came from various herds and were grouped by the sellers according to the age. After transport, they were placed under sheds and grouped in five pens

of 4 animals each, the pens were fully isolated with walls. One week after transport, the breeder noticed the first symptoms of disease: losing weight, lethargy, apathy, loose stools. The calves still had appetite though. Four calves died 4-5 days after deterioration of their health condition.

A veterinarian was called to euthanize the calf which was in an agonal condition and performed necropsy which showed minor hyperaemia of small intestines; a small amount of mucous was present in the intestines and a small amount of digested intestinal content. The mucous membrane was engorged. Parts of small intestines and a faecal sample were collected for diagnostic purpose. Two rapid plate tests were performed: one of them excluded *Cryptosporidium*, *E.coli K99*, rotavirus and coronavirus infections; the second showed presence of *C.perfringens* in the calf faeces. The ligated intestinal sections were sent to laboratory where presence of *C.perfringens* and its toxin α was confirmed. Also *Salmonella typhimurium* and non-haemolytic *E.coli* were found too.

In calves with symptoms, the following treatment protocol was started: amoxicillin and clavulanic acid as well as enrofloxacin in injection for 5 days. The applied therapy allowed to achieve the expected results – calves were active and their performance was better. However, the slow growth rate of the animals which suffered from the infection and a long regeneration of the gastrointestinal tract, in particularly due to lymphatic villi epithelium regeneration will result in obvious differences between them and the rest of the herd.

The infection caused by *S.typhimurium*, according to Act of 11 March 2004 on Protection of Animal Health and Control of Infectious Diseases of Animals in Poland, was reported to the District Veterinary Officer.

Bibliography:

1. *Goossens E. et al., 2017. Rethinking the role of alpha toxin in Clostridium perfringens-associated enteric diseases: a review on bovine necro-haemorrhagic enteritis. Veterinary Research*
2. *Małek W. et al., 2007. Wyspy patogeniczności. Medycyna weterynaryjna, nr 63 (9)*
3. *Chaudhuri D. et al., 2018. Salmonella Typhimurium Infection Leads to Colonization of the Mouse Brain and Is Not Completely Cured With Antibiotics. Front. Microbiol*
4. *Rypuła K. et al., 2012. Zakażenia zwierząt przez Clostridium perfringens. Życie weterynaryjne, nr 87(3)*
5. *Santos R. L. et al., 2002. Morphologic and molecular characterization of Salmonella typhimurium infection in neonatal calves. Vet Pathol, 39.*

Clostridium perfringens Ag
- RAPID DIAGNOSTIC TEST

The test consists of two monoclonal antibodies detecting not only ***C. perfringens*** bacteria, but also the alpha toxin it produces.

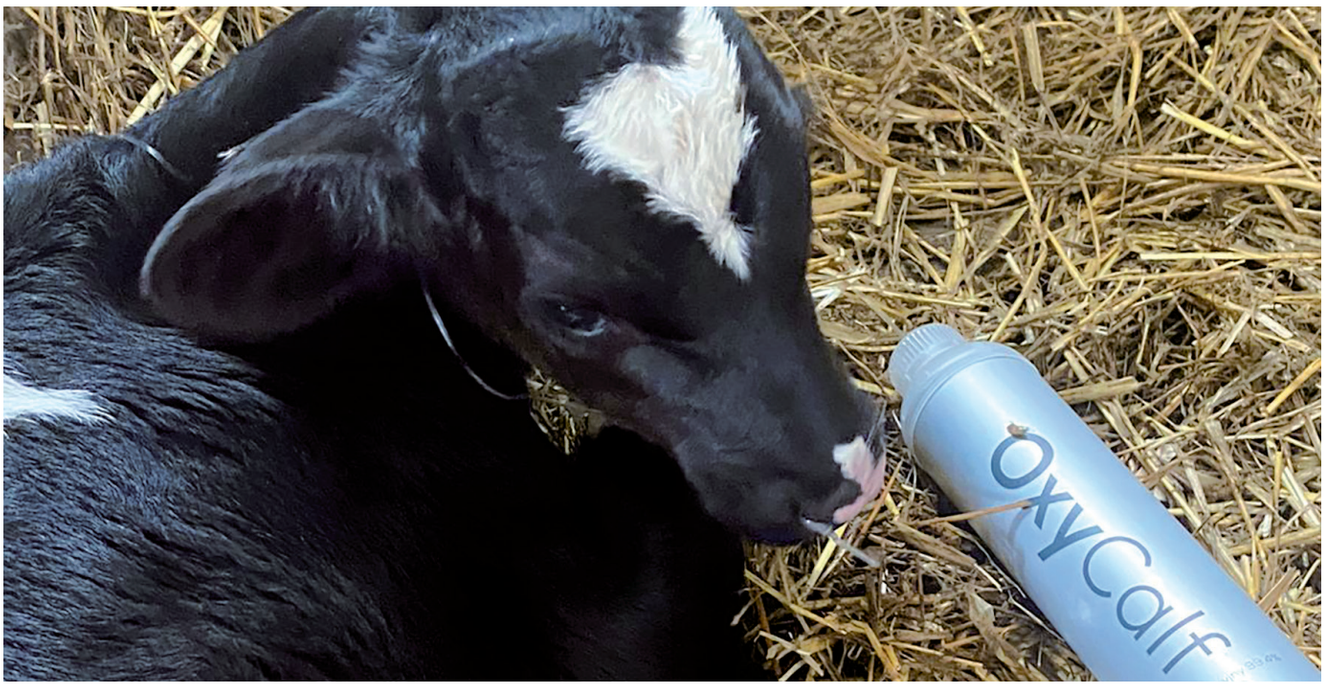
The test is designed to give a positive result only in the situation where the antigen concentration exceeds the level of $4{,}125 \times 10^6$ CFU/ml.

The C. perfringens test is a method quantitative, not qualitative. Designed by takeing into account the fact that ***Clostridium*** contributes to the physiological microflora of gastrointestinal tract - a positive result means that this microorganism changed its own nature and became a pathogen.

- High sensitivity and specificity.
- Precise diagnosis in few minutes.
- Enables treatment monitoring.

VET EXPERT
BASED ON EVIDENCE

Neutralization of respiratory and metabolic acidosis with OxyCalf



An interview with Izabela Morawska-Krasińska who is an owner of a veterinary practice in Czernikowo (Torun district, kujawsko-pomorskie voivodship)

When did you start using OxyCaf in calves?

Immediately after I became acquainted with this new product and I found it interesting. In the field we did not have a possibility to oxygenate weak calves and accelerate their recovery after a difficult parturition.

In which cases OxyCalf is the most effective?

We use it in calves which do not have a proper and effective respiratory reflex after calving. It usually happens in newly born heifers, in particular in case of insufficient dilation of the cervix and in calves with high body weight. We always try to have a can just in case because we never know how the parturition ends up. Many times we have to deal with uterine torsions, caesarean sections and giving birth to twins which result in weak and hypoxemic calves being born.

What protocol of OxyCalf application do you follow in your practice?

At first in newly born and hypoxemic calves we clean the nostrils to clear its airways and to eliminate the accumulated mucous. Weak calves are rarely strong enough to do it so we need to help them. After placement of a loop of the tube, we insert its ending into the calve nostrils and open the valve. We oxygenate the animal until it starts to lift its head and attempts to stand up. It happens that we repeat the inhalation in calves which are still sluggish a few hours after calving – the symptoms of acidosis sometimes become exacerbated because of the insufficient ventilation of the lungs. Thanks to the possibility of closing the valve at any moment, we usually use OxyCalf to oxygenate two or three calves, depending on the amount of oxygen which remains in the can.

What other applications of the product can you recommend?

Taking into consideration that we run a mixed practice, we sometimes use OxyCalf in piglets (we oxygenate up to 10 animals with one can) and dogs or cats after birth or during recovery from anaesthesia. It is also possible to oxygenate a transporter with an animal provided that the walls and openings are tight.

Why OxyCalf?

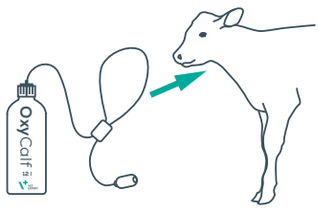
As a result of a difficult and prolonged parturition functioning of the placenta becomes disturbed. As a consequence, CO_2 and lactic acid accumulate in the calf's body and they cannot be removed via the placenta. After calving and starting normal respiration (through lung ventilation), the amount of previously accumulated lactic acid increases in the body tissues. It results in acidification of the calf body which – when pH drops below 6.8 – may pose a threat to the animal's life. A respiratory and metabolic acidosis is one the main causes of a weak calf; insufficient lung ventilation contributes to deterioration of the animal condition and prevents effective elimination of CO_2 which became accumulated as a result of a difficult parturition.

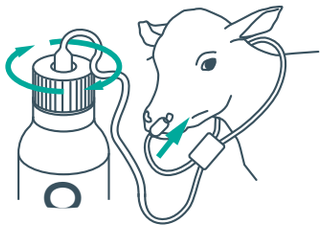
OxyCalf

THE ONLY ON MARKET INHALATION OXYGEN WITH 99,4% PURITY

PROPERTIES:

- It enhances functioning of the circulatory and respiratory systems
- It makes it easier for a calf to start breathing on its own
- It helps to stabilize acid-base balance in the body
- It significantly supports calves in the first hours of life





OxyCalf is a concentrated pure breathing oxygen which enables to facilitate ventilation of newly born calves and prevents negative consequences of metabolic and respiratory acidosis.

Stabilization of the rumen pH is the key for safe transition period

Izabela Gwincińska M.Sc. Eng., Vet Tech

The most important factor which guarantees the success of transition period is optimum functioning of the rumen and the local microbiome. The microbiome is specific for the species and the individual animal. In each cow, particular types of microbes are present in defined proportions and the feed given to animals determines minor changes in its composition. The rumen microbial diversity determines effective digestion of the structural polysaccharides (cellulose, hemicellulose, lignin), production of bacterial protein (a component of high biological value), fermentation and physical degradation of the feed. The rumen microbiome includes: bacteria (about 10^{11} of cells in 1 ml of the rumen fluid), protozoa (about 10^{6} cells in 1 ml of the rumen fluid) and fungi (about 10^{3} of the cells in 1 ml of the rumen fluid).

The change of feed during dry period, stress and the increasing strain on the body may result in the change of rumen pH which may lead to modification of the number of local microbes. It leads to digestive problems and reduction of the energy obtained from the ration – the consequence may be ketosis (resulting from a negative energy balance) or acidosis (caused by pH reduction and multiplication of pathogens in the rumen).

Why is the rumen pH so important?

Maintenance of the stable rumen pH provides the microbes with ideal conditions for growth which enables effective digestion and absorption of nutrients from the feed. Efficient rumen bacteria also produce high quality proteins and fatty acids which are glucose precursors and prevent a negative energy balance after the parturition.

Normal rumen pH varies between 5.5 and 7.0. Cow body is equipped with a mechanism which allows to stabilize this parameter but nutritional mistakes, in particular in highly productive cows, lead to a reduction of pH which results in (subclinical or clinical) acidosis. Starch fermentation in the rumen results in secretion of glucose. It is used by rumen bacteria and contributes to the growth of its population and effective digestion. As a result of metabolic changes, the rumen microbes produce volatile fatty acids – which are a substrate for milk production, a glucose precursor (energy) and they also allow to maintain pH at the level below 7.0. Some bacteria produce lactic acid (e.g. *Streptococcus bovis*, Lactobacillus spp.) too which reduces pH about 10 times more than other volatile fatty acids – however in the rumen there are bacteria (including S*elenomonas spp.*, *Anaerovibrio spp.*, Megasphaera elsdenii or *Propionibacterium spp.*) degrading lactic acid or protozoa (*Entodinium spp.*) which prevent its excessive secretion and significant reduction of pH in the rumen.

There are carbonic and phosphate buffers in the cow's saliva which neutralize 30-40% of the acids produced in the rumen. However, this process depends on the cow's mastication since the quantity of the produced saliva is not related to the rumen pH (it does not work as a system which prevents acidosis) but on the amount of the physically effective fibre in the ration. It may be increased by feeding forage with molecules over 1 cm long (optimum 2-3 cm) and also by addition of neutral detergent fibre (NDF which is ADF fraction of the cellular wall of the fodder + hemicellulose). This fibre is present in the forage (its content and digestibility is closely related to the term of harvesting and its storage); hey and straw should be inseparable components of the ration since they contribute to a longer mastication time as well as production and secretion of the saliva which buffer the acidic content of the rumen. Feeding highly productive cows means however the reduction of this type of feed in favour of concentrates which meet the high energy and nutrient requirements of cows but at the same time reduce the mastication time leading to the increased fermentation and reduction of the rumen pH. It however contributes to the body acidification. It also should be mentioned that the low rumen and intestine pH favours multiplication of enterohemorrhagic *Escherichia coli* O157:H7 – this strain causes bloody diarrhoea and reduces the immunity thus it leads to secondary mastitis and hoof diseases.

Stabilization of the rumen environment

The composition and proportions in the rumen microbiome of an adult cow are. Reduction of pH results adversely affects the proportion and leads to digestive problems and a limited use of nutrients as well as a productive potential of bacteria. The rumen environment may be stabilized by medications or substances with ionophoric effect – they destabilize cellular membranes of Gram+ bacteria and make it possible for amylolytic and cellulolytic bacteria to function. It results in the improvement of the fibre and starch digestibility which increases production of volatile fatty acids and reduces loss of dietary protein.

Improvement of the digestibility of feed components results in higher intake but also in higher quantity of available microbiological protein. It may be easily evaluated on the basis of urea level in the milk – its reduction will indicate a higher consumption in the rumen associated with production of bacterial protein. More effective fermentation process leads to higher secretion of volatile fatty acids, in particular of the propionic acid which is a glucose precursor providing more energy without causing acidosis. Higher consumption and intake of energy are essential to shorten the period of a negative energy balance. The ability to modify rumen microbiome plays an important role in effective fermentation and feed efficiency. It is a challenge, especially in highly effective cows. What is important here is the fact that lactation does not begin with calving but with beginning of dry period. The preparation of the cow for this period, its BCS and ration formulation will affect parturition, calcium and phosphorus metabolism as well as cow's performance during lactation and effective beginning of the subsequent productive cycle.

BOVICOMPLEX
SUPPORT FOR RUMEN'S pH STABILIZATION

GRAMMAGE OF 4 kg AND 1 kg!

CASHEW SEEDS OIL

CALCIUM CARBONATE

BOVICOMPLEX, thanks to the high content of cashew seeds oil, has a positive effect on functioning of the rumen microflora by modifying it's environment and stimulation the growth of amylolytic and cellulolytic bacteria.

- prevention of subclinical and clinical acidosis
- better feed intake
- higher production of VFAs, especially propionic acid
  → source of energy that prevent ketosis
- improvement of rumen fermentation
  → greater milk yield

Simple solution for a healthy transition period

The non-infectious and infectious risk factors of the respiratory diseases in calves.

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Respiratory diseases occur commonly in calves in Poland. According to literature the morbidity rate varies between 33% and 67%. Within-barn environmental conditions such as humidity and temperature play a key role in development of the disease and determine the severity of symptoms. The most commonly observed symptoms include cough, respiratory murmurs, nasal discharge and dyspnoea.

Respiratory diseases are becoming an increasing challenge in the modern cattle production and are strictly related to zoohygenic conditions in the barn, stress and movement of animals. The mentioned non-infectious agents cause immunodeficiency which may lead to infection.

Impaired respiratory function is observed in animals regardless of the breed, body weight or living conditions. The estimated costs of respiratory diseases in Europe equal up to half of billion Euro per year and are related to the necessity to treat sick animals as well as to deaths and subsequent losses associated with reduced growth rate or milk yield in animals which suffered from respiratory problems. Pneumonia results in reduction of ADG by 66 points only in the first month of life. The growth rate becomes reduced by about 8% in calves which recovered from pneumonia and by 29% in calves which suffered from pneumonia and diarrhoea. Young calves are most susceptible to infection and the disease is observed in both: the calves which are born and raised at the farm as well as in the purchased animals.

Out of all the farm animals, cattle is the most susceptible to respiratory diseases due to anatomical and physiological features:

- The respiratory surface of the lungs is insufficient in relation to the needs;
- Narrow larynx and trachea, which increase the respiratory rate and thus inhalation of harmful particles;
- Alveoli are surrounded by a relatively thick interlobular connective tissue with relatively scarce capillary vessels which do not perform an effective gas exchange.
- Tracheal bronchus which contributes to enhanced gas circulation deteriorating aeration.

The respiratory diseases are usually diagnosed in dairy calves at 3 to 4 weeks of life (at the beginning of the immunity gap) and in beef calves at weaning. Respiratory abnormalities are becoming increasingly common in purchased calves which are often kept in too numerous groups where they are exposed to infectious and environmental agents which will be further discussed.

Non-infectious agents which contribute to the respiratory infections.

A veterinarian does not have a direct impact on the majority of aspects which contribute to development of respiratory diseases, However, it should not prevent them from active collaboration with a farmer as well as from supporting and educating them in order to provide the animals with the best possible rearing conditions. The main non-infectious agents in barns and calf shed include:

- Inadequate colostrum intake
- Choking
- Zoohygenic conditions in the barn and calf shed
- Stress
- Movement and crowding of animals
- Insufficient biosecurity

Colostrum feeding

It is the key (and still underestimated) factor which promotes health of calves in the first weeks of life. Due to the lack of immunoglobulin transfer in the foetal life, calves are at risk of their deficiency. Colostrum is the only source of immunity. It is important, whenever possible, to feed calves with colostrum from cows which are kept on the same farm – since colostrum contains antibodies against pathogens to which calves will be exposed in the specific barn. A calf which weighs 45 kg should drink at least 4 kg of a good quality colostrum in the first 8-12 hours of life; the first dose should be given within maximally 4 hours after birth. The most valuable colostrum is obtained from cows which are properly fed during the drying period and immediately after calving (replenishment of nutrients) as well from the cows which are vaccinated against pathogens which induce respiratory and gastrointestinal diseases.

Apart from numerous immunoglobulins and nutrients, colostrum contains active leukocytes and acute phase proteins which stimulate production of mucin in intestinal cells. It enhances digestion and absorption (which plays a key role in case of immunoglobulins) as well as reduces the possibility of pathogenic bacteria adherence to the gastrointestinal mucous membrane.

It protects calves from becoming sick in the first days of life provided that good quality colostrum will be fed in the correct way.

In order to correctly feed colostrum, its quality and the level of immunity transfer should be con-

Foto 1.

Examination of colostrum collected from a cow 13 hours after calving. The result in %BRIX scale = 22.9 means that the content of IgG is at the level > 50 g/L, the quality of colostrum is defined as GOOD – it is sufficient to give it to a calf in the first 2 hours of life without the necessity to provide additional supplementation.

Foto 2.

A typical posture of an animal with respiratory problems: extended neck, open mouth, abducted elbows, it should facilitate respiration, ear position and apathetic gaze indicate malaise of the animal. The respiratory rate is significantly higher as compared to a healthy calf.

trolled. It may be performed with colostrometer or refractometer. Feeding of 15 g of Ig/l of serum in the second day of life is considered to be sufficient; in calves with the level of Ig equal to 5-10 g/l of serum the gastrointestinal or/and respiratory diseases are more frequently observed and the course of disease is more acute than in the calves with immunity transfer at the level > 10 g of IgG/l of serum. Table 1 shows interpretation of the level of passive immunity transfer in calves.

Zoohygenic conditions in the barn/ calf shed

Habitat in which the calf is reared is one of the most important rearing factors. The climate in this part of Europe and specific model of the current farming contribute to keeping animals inside the farm facilities for several months. Thus, the internal conditions should be regularly controlled and modified accordingly with the needs of animals from various technological groups.

One of the most important zoohygenic conditions in the barn is ventilation. Accumulation of gases (in particular of hydrogen sulphide and ammonia), which often are not detectable for a farmer or a veterinarian during the visits in the barn, pose a great threat for calves. The calf nose is kept at the lower level therefore in order to determine whether the gas concentration in the facility is high, it is enough to squat down for at least 2 minutes – it will expose olfactory organs to the conditions under which calves live. Development of dyspnoea or lacrimation will indicate insufficient ventilation of the barn. Air contaminated with gas or dust/ powder may reduce clearance of pulmonary mucous membrane, damage respiratory tract as well as reduce the level of macrophages in alveoli which favours viral infections. The proper ventilation allows to eliminate from the air any contaminants, including circulating pathogens which – when transmitted with droplets – may infect other animals. It mainly refers to such viruses as: BPIV-3, BRSV, BVDV, BoHV-1 or BCoV. Air humidity is also a crucial factor which determines normal functioning of the body – the mentioned viruses (which contain hydrophobic capsule) remain active for a longer time when the humidity is low.

Calves which are kept in individual pens or in a group of animals at the same age are significantly less exposed to infection that those which are placed in mixed groups including animals of various age or originating from various herds. Calves should be grouped in a calf shed according to their age – it will limit transmission of infectious agents and eating of feed which is not adjusted to the needs of younger animals. Ventilation in the building should move the air from the youngest to older animals in order to protect the most sensitive animals from aerogenic infections.

Temperature in the facilities should be, whenever possible, stable (and not be subjected to big changes within a short period of time) – not to high and not too low. The activity of pathogens is higher in low temperature which also contributes to longer exposure of the mucous membrane of the respiratory tract

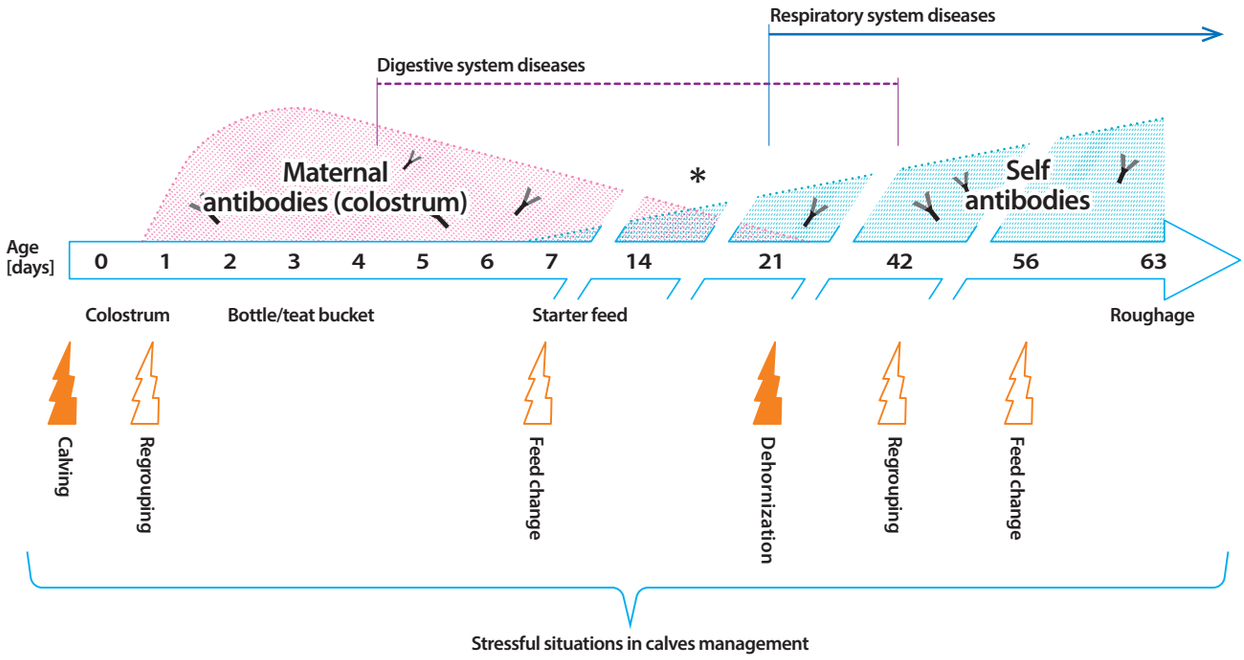
Table 1.

%Brix (serum)	Ig concentration (g/l)	Interpretation
7,5	4,5	A very low level, additional supplementation is required
8,0	10,1	Sufficient level, the additional supplementation is recommendable
8,5	15,6	
9,0	21,2	Optimum level of immunity transfer
9,5	26,7	
10,0	32,2	High level of immunity transfer
10,5	37,8	
11,0	43,3	
11,5	48,9	
12,0	54,4	

The level of passive immunity transfer – interpretation of results according to the %BRIX scale.

Fig. 1.

Stressful situations which occur in the process of rearing calves



to pathogens due to the lower mucosal clearance. However, when the temperature is too high, the respiratory rate becomes increased which on the one hand enhances shedding of pathogens by the infected animals and on the other hand – enhances inhalation of the contaminated air by healthy calves.

Movement of animals

Transport of animals is considered to be one of the most important non-infectious risk factors of respiratory diseases. It is confirmed by the term "transport fever" defining diseases which occur in association with animal transport. The increasing rearing of dairy bulls has led to a higher number of movements of animals from the birth place to the farm where they are reared. When planning transport, we should avoid the excessive crowding of animals which contributes to transmission of infections. The most unfavourable conditions which accompany movement of animals include: long duration of transport, grouping of animals from various herds, crowding (insufficient ventilation, high temperature), stress related to the change of location and temporary unavailability of water and feed as well the impairment of immunity.

When planning movement of calves to calf sheds, the planned vaccination schedule should be considered – the animals should be moved only after developing a full post-vaccination immunity. The vaccination program should not be started immediately after movement of calves because it is a source of stress for them and subsequent immunosuppression will not allow to achieve the proper effect of vaccination.

When admission of animal transport is planned, it should be checked if calves do not come from various sites and duration of transport is not too long. After arrival to the destination, the calves should be assigned to a 14-21 day quarantine since the largest quantity of pathogens is shed in the first days after infection. Transmission of pathogens becomes limited approximately on the 14th day. Checking the transported animals for BVD virus should be a standard and in case of the obtaining the positive result in individual animals, they should be eliminated from the herd. The growth rate of PI animals will be significantly lower as compared to healthy animals and large quantities of virus will be shed. Not only will other animals become infected within a short period of time but also the virus will induce immunosuppression which may lead to a secondary infection caused by pathogens which are present in the herd.

Stress

The mentioned non-infectious agents contribute to respiratory infections and also cause thermic, transport, social, nutritional and other types of stress which negatively affect functioning of calves mainly due to the induced immunosuppression favouring bacterial and viral infection by pathogens which reside in the calf habitat. Stress affects immunity via a complex mechanism which involves the increase of the susceptibility to viral infections secondary to glucocorticoids and catecholamine secretion. These molecules supress the production of Th1 lymphocytes which are involved in mechanisms of cellular immunity. At the same time, they stimulate production of Th2 lymphocytes which are associated with humoral (extracellular) immunity. Therefore, under stressful conditions, the body has a limited possibility to combat infections caused by intracellular viruses and bacteria.

The stressful agents suppress the immune system also by affecting the life cycle of leukocytes, ability of macrophages to phagocyte and migrate as well to produce cytokines. In the first days after transport, it is not recommended to vaccinate the animals because the stress-related agents still remain active and disturb production of antibodies during the

immune response which is noticeable in case of BHV-1 or BRSV viruses. Besides, cortisol which is produced under stress conditions, limits production of sIgA immunoglobulins which are active within the mucous membranes of the upper respiratory tract. It limits defence mechanisms protecting against adhesion of pathogens to the mucous membrane of the larynx and trachea as well as leads to lack of neutralization of toxins which are produced by bacteria.

The figures 1 shows an extensive impact of stressful situations, associated with various methods of rearing, on functioning and health of calves. The diagram should be completed with potential additional stressful factors which are specific for the farm or even the individual animal.

Infectious agents which cause respiratory diseases

Bovine respiratory diseases (BRD) are the most common health problem in calves up to 12 months of life. They are multifactorial conditions and the most important agents are viruses: BRSV1, PI3, IBR and *Mycoplasma* which may be the primary cause of disease. Damage of the epithelium of the respiratory tract and in particular of bronchi favours the secondary bacterial infections including the most important agents such as: *Pasteurella multocida, Mannheimia haemolytica, Histophilus somni*.

BRSV (Bovine respiratory syncytial virus)

BRSV belongs to the genus *Pneumovirus* from the family *Paramyxoviridae*. Since it is an enveloped virus, it is susceptible to environmental conditions and disinfectants. Respiratory syncytial virus is found endemically in the global cattle population and is one of the main factors which cause the cattle respiratory diseases. The infection takes place via direct contact. The incubation period varies between 2 and 5 days. Almost 60% of animals become infected and the mortality rarely exceeds 10%, however this proportion is strongly correlated with the animal age in the moment of infection, in young animals the disease is more severe. Animals under 1 year of age (from 3 to 12 months old) are especially susceptible and they may suffer from severe disease of the upper and lower respiratory tract. The most common symptoms include increased respiratory rate, fever and lack of appetite. In adult animals, the disease is asymptomatic. There are effective vaccines available on the market.

PI3 (Parainfluenza 3 virus)

The infection usually is mild or even subclinical. It plays, however, an important role in development of the secondary bacterial pneumonia. The infection is transmitted by direct contact or via aerosol. The most common clinical symptoms include: fever, cough, serous nasal discharge, accelerated respiration and pulmonary murmurs. Recombinant vaccines including also other BRD important agents are available.

IBR (infectious bovine rhinotracheitis)

Infectious bovine rhinotracheitis is a disease caused by bovine herpesvirus type 1 (BHV-1). It spreads via direct and indirect contact, sexual contact, insemination, tools and equipment used to handle animals as well as via aerogenic route. This virus may be also transmitted by persons which handle animals. After recovery, the infected animals become asymptomatic carriers and in the periods of stress exposure, the dormant BHV-1 may become activated/reactivated and is spread by the these animals which infect other animals in the herd. Animals with latent infection play an important role in spreading disease in the herd. Animal at each age become sick and the morbidity rate varies from 20 up to even 100%. The course of disease varies. A sudden onset of the disease may be observed and the symptoms are shown by the majority of animals in the herd. But transmission may be gradual and symptoms are then seen in individual animals. The most common manifestations include fever (up to 42°C), apathy, lack of appetite, serous nasal discharge (which becomes mucous or even purulent over time), conjunctivitis, salivation, dry and paroxysmal cough, dyspnoea and in adult animals – a sudden drop of milk yield, stillbirths, abortions, aspiration pneumonia. New born calves show aspiration pneumonia, palatal erosions, diarrhoea, dehydration, weakening and death. There is an obligation to register the disease in Poland (attachment No 2 to the Act of 11th March 2004 on Protection of Animal Health and Control of Infectious Diseases of Animals). Since 2005 it has been allowed to use vaccines as they reduce the proportion of the infected animals and limit economic losses.

Treatment and prevention

The most important method to fight BRD is prevention and limitation of the exposure to infectious factors. Calves which have already become sick, should be treated and the most commonly applied method is antibiotic therapy. Fast and effective treatment is incredibly important since the exacerbating pulmonary injury increases the risk of emaciation of animals. Inadequately chosen and thus ineffective treatment extends the duration of antibiotic therapy. It is commonly known that it may be accompanied by diarrhoea which is a result of disturbed gastrointestinal microbiome. Diarrhoea in an animal which has already been debilitated, additionally contributes to a limited growth rate, emaciation and as result to economic losses. Addition of herbal supplements which have an exuberant effect and dilute respiratory secretion allows to achieve therapeutic goals within a shorter period of time and may be an effective way to support antibiotic therapy. When buying or moving animals or in any stressful situations, the necessary measures should be taken in order to select vaccines and to use preventive formulation to minimize the risk of respiratory diseases. After noticing the symptoms of the disease, a dedicated treatment should be started as soon as possible. Blanket application of products which support respiratory function and are given in water or feed to other animals in the herd should be considered

The list of literature is available from the authors.

POOLMOPLEX
IMPROVES THE FUNCTIONING OF RESPIRATORY TRACT

PACKAGE OF 1 kg AND 4 kg

YEASTS | ESSENTIAL OILS | THYMOL | CAROB TREE | FEEDING WITH DAILY RATE

WHAT DO YOU GAIN?

- the best support in BRD therapy,
- improved ventilation of the respiratory tract,
- faster removal of secretion from the lungs,
- more effective therapeutic effect,
- easy application with daily rate,
- stabilization of digestion (important while using an antibiotic!)