

This manuscript has been published in the IVIS website with the permission of the congress organizers.

To return to the Table of Content [click here](#) or go to <http://www.ivis.org>



RESPIRATORY DISEASE IN ADULT CATTLE

Renaud Maillard¹, Sébastien Assié², Alain Douart²

¹Unité Pathologie du Bétail, Ecole Nationale Vétérinaire, Alfort, Maisons-Alfort, France
rmaillard@vet-alfort.fr

²Médecine des Animaux d'Élevage, Ecole Nationale Vétérinaire, Nantes, France

1. INTRODUCTION

Respiratory disease in cattle is often associated with the youngest animals such as calves, heifers or steers (Hartel *et al.* 2004; Ames, 1997). Most cases appear before the age of two-years old (if not before the end of the first month of life-Crowe, 2001), and respiratory disease is a major cause of losses, particularly in beef cattle production (Prado *et al.* 2005; Kapil & Basaraba, 1997; Johnson, 1991).

Does it mean that respiratory disease in adult cattle is not a matter of concern?

Obviously respiratory disease in adult cow is not a disease of major importance: except outbreaks of IBR (Infectious Bovine Rhinotracheitis) (Pastoret & Thiry, 1985; Thiry *et al.* 1985) or infection by the respiratory coronavirus (Hazoksuz *et al.* 2005; Crouch *et al.* 2000; Alenius *et al.* 1991; Collins *et al.* 1987) or the controversial role of the bovine respiratory syncytial virus (BRSV) (Kimman *et al.* 1988; Paccaud & Jacquier, 1970), respiratory disease is uncommon in adult beef cattle (Breeze, 1985). In dairy cattle, respiratory disease is not as frequent as reproduction disorders, metabolic diseases, lameness, and displacement of abomasum (Norstrom *et al.* 2001).

The economical impact of respiratory disease in adults seems of minor importance. Most cases of pneumonias are sporadic, and they are not a primary cause of culling at the herd level (Selman *et al.* 1977).

Despite these facts, the practitioners are often facing cases of respiratory disease especially when dairy cows are outside on the pastures. These episodes raise many questions such as:

- the origin of the disease (viral, bacterial or parasitic), because of the contagious aspect at herd level,
- the persistent or chronic aspect of the cough, an aspect always unacceptable for the farmer,
- the impact of milk losses and of direct losses (cost of the treatment),
- the strategy of diagnosis and control.

In fact, the diagnosis of respiratory disease in adult cattle is a challenge for the practitioner:

- adult cattle can less easily be examined,
- outbreaks are often observed outside, and not in stables,
- clinical observations are often limited to inconstant hyperthermia, cough, polypnea and milk yield drop,
- “classical” ways to assess the diagnosis (i.e. serology, nasal swabs, trans tracheal aspiration or lung washing) often give poor results,
- antimicrobial therapy is less easily applicable, because of its cost (related directly to the weight and the number of animals) and of the withdrawal period.

In this presentation, we will successively describe:

- the possible causes of adult respiratory disease,
- a clinical and epidemiological approach,
- a global strategy when facing such cases.

We will consider “adult cows” animals older than 2 years or after the first calving.

We will not develop tuberculosis (*Mycobacterium bovis* infection) and contagious bovine pleuropneumonia (*Mycoplasma mycoides* subsp. *mycoides* small colony type infections) even if they are still major concerns in large parts of the world.

Less information will be provided on viral diseases than other causes of respiratory disease as details are gathered in the review “Viral respiratory infections in cattle” by Valarcher & Hägglund.

2. ETIOLOGY AND CLINICS OF RESPIRATORY DISEASE IN ADULT CATTLE

Major causes of respiratory disease in adult cows are listed in Table I. For each one, the agent is indicated, the animals affected (only cows or all ages) as the frequency of the disease, the importance and the common presentation in a herd (sporadic vs. enzootic).

Table I: Main respiratory disorders in cows: cause and epidemiology

Name	Agent	Frequency	Clinical Impact	Affected animals	Epidemiology
Rhinitis	Bacterial, fungic irritant, allergic	+	+	Young > old	Sporadic or enzootic
Sinusitis	Various	++	++	Young > old	Sporadic (Dehorning)
Laryngitis	Various	+	+++	Young > old	Enzootic for youngsters Sporadic in adults
IBR	BoHV1	Variable	0 to +++++ Commercial impact	All ages	Enzootic
Pneumonic <i>Pasteurella</i> +/- pleuritis	<i>M. haemolytica</i> <i>P. multocida</i>	++++	++++	All ages Young > old	Enzootic Sporadic and chronic possible if ineffective primary therapy
Pneumonic <i>Mycoplasma</i>	<i>Mycoplasma bovis</i>	+++	++++	All ages	Enzootic Associated signs: arthritis (youngsters) Mastitis (adults)
Viral interstitial pneumonia	BRSV PI3 <i>Adenovirus</i> BVD (associated)	+++++	++++	All ages Young>>old	Enzootic (youngsters) Enzootic but rare and clinically undifferentiated in adults (cough, milk drop...)
Lungworm	<i>Dictyocaulus viviparus</i>	0 to +++++	+ to +++++	All ages now possible	Enzootic (contagious aspect) Chronic aspect
Ehrlichiosis	<i>Anaplasma phagocytophilum</i>	Often unknown 0 to +++?	0 to +++	Old > young	Enzootic (contagious aspect)
Q fever	<i>Coxiella burnettii</i>	?	0 to ++ (respiratory signs)	Old > young	Enzootic Associated sign : abortion
Catarrhal malignant fever	OvHV2 AHV1	+	+++++	Old > young	Sporadic Multiple associated signs Death
Fog fever	3 MI	+	++++	Old	Enzootic: pasture-associated syndrome Sporadic
Vena caval thrombosis	Pulmonary thrombo-embolism	+	+++++	Old > young	Multiple associated signs Possible confusion with chronic pneumonia
Extrinsic allergic alveolitis	<i>Micropolyspora foeni</i> and other spores	++	++++	Old	Sporadic
Tumor	Primary or secondary	rare	++++	Old	Sporadic
Fibrosing alveolitis	Unknown	rare	++++	> 6 years	Sporadic

Respiratory disease in cows can be considered using dichotomies:

- first the disorders common to young and adult cattle vs. the disorders of the sole adult,
- then the sporadic (a single case to a few cases) disorders vs. the enzootic ones,
- finally, the chronic disorders vs. the acute disorders.

2.1 Disorders of the adults/of all ages

Disorders mainly associated with adult cows are tumors, vena caval thrombosis, fibrosing alveolitis, fog fever (or Acute Bovine Pulmonary Edema and Emphysema-ABPE), extrinsic allergic alveolitis (or hypersensitivity pneumonia or farmer's lung), all allergies (including milk allergy), malignant catarrhal fever, ehrlichiosis, Q fever and general diseases of the old patient with a secondary respiratory impact, such as chronic cardiac failure or aneurysm of the carotid (Chandler *et al.* 2001). Tumors are often only diagnosed at necropsy (Selman *et al.* 1977; Anderson *et al.* 1969; Anderson & Sandison, 1968). They can be primary in the respiratory tract or secondary to another cancer. They can even be located out of the respiratory tract but able to induce respiratory disorders (Matsuda *et al.* 2003). In the first case, clinical signs can be limited to respiratory disorders; in the second case clinical signs rely also on the primary cancer (Matsuda *et al.* 2003; Kumamoto *et al.* 1997; Breeze, 1985). Lung tumors *sensu stricto* are uncommon (19 cases per million cattle slaughtered) and secondary tumors are more frequent (43 cases per million), for a total representing about 8% of the cancers in cow (Anderson *et al.* 1969; Anderson & Sandison, 1968).

Vena cava thrombosis is more frequent in the caudal vena cava than in cranial vena cava, but in both cases the predominant signs (weight loss, dyspnea, fever, and cough) mimic chronic pneumonia signs (Braun *et al.* 2002; Mills & Pace, 1990; Rehman *et al.* 1980). In fact, suppurative pneumonia or multiple lung abscesses can be in a second step a consequence of pulmonary arterial embolism. The initial thrombus can be found at necropsy either in the liver or in the thorax (Braun *et al.* 2002; Breeze *et al.* 1976). Sudden death is quite possible (Peek, 2005). *In vivo* diagnosis is easier when anemia, melena, thoracic pain, hepatomegaly or ascites and overall hemoptysis are present.

Fibrosing alveolitis is a chronic disease of the older animals (> 6 years). Permanent cough, tachypnea (> 50 per minute) contrast with the good appetite of the animal. Diagnosis is made at necropsy (or biopsy?) and microscopic examination (Scott *et al.* 1997; Breeze, 1985).

ABPE rarely occur before the age of 2 years, but cases are described in feedlots (Loneragan *et al.* 2001; Johnson, 1991). It can be considered as poisoning by endogenous 3 methylindole and 3 methylindoleine. Fog (for "foggage") fever is classically associated with a change in grazing, from a poor pasture to a rich one. The disease appears suddenly within 3 weeks and is mainly characterized by acute tachypnea and dyspnea. Death is possible in 30% cases (Peek, 2005; Breeze, 1985; Selman *et al.* 1976).

Farmer's lung occurs in adult cattle (and often it involves also the farmer) after multiple and repeated exposures to dust or moldy hay containing spores of *Micropolyspora foeni* (Breeze, 1985). It is a form of hypersensitivity pneumonia, many other allergens exist which can induce similar disorders. It is a problem common to cattle and farmers (Berger *et al.* 2005). Acute onset of coughing, fever and milk drop reveals a recent contact with the allergen. A chronic form exists, with milk drop, weight loss and frequent cough. Other hypersensitivity diseases exist in old cattle, with a variable respiratory component and, except for systemic anaphylaxis, are extremely difficult to a diagnosis (Selman *et al.* 1977). Corticoids remain an important part of the therapy.

In Europe, malignant catarrhal fever is due to an ovine herpes virus (OvHV2), but bovine infection is not always characterised by clinical signs (Powers *et al.* 2005). Farms in which sheep and cattle are bred are the most exposed. Incubation is long, up to 6 months. Part of clinical signs (anorexia, prostration, milk drop, fever, nasal discharge, and dyspnea) can evoke acute forms of IBR (Callan & Van Metre, 2004; Callan & Gary, 2002; Lemaire *et al.* 1994; Pastoret & Thiry, 1985).

Ehrlichiosis (“pasture fever”) is a non-contagious, tick-borne disease (Pusterla *et al.* 1998, 1999). Infection by *A. phagocytophilum* may be unapparent or asymptomatic. In naïve heifers or cows, clinical signs are often severe. They include fever, milk drop, cough, tachypnea, and sometimes edema of the distal part of the legs. Evolution inside a herd can last a few months. Diagnosis is achieved with the necessary help of the laboratory: direct examination of a blood smear, serology, PCR. Tetracycline is the base of the treatment. Destruction of tick biotopes is the base of a prophylaxis. The agent of bovine ehrlichiosis is also the agent of human anaplasmosis and cattle outbreaks may be the marker of a zone at risk for human infection (Joncour, 2004).

2.2 Sporadic disorders/enzootic disorders

Enzootic disorders are associated with microbial and contagious agents or management practices or both (Callan & Gary, 2002; Babiuk *et al.* 1988; Wathes *et al.* 1983).

Microbial agents are more likely than other agents to be responsible of collective illness. In this case, we must suspect the whole herd (or certain groups of animals) to be exposed at the same time to the same agent. We must also suspect all (or most part of) adult animals to be susceptible to the agent, mainly because of naïve or incomplete immunity or absence of effective vaccination.

This is not a common situation for viruses and bacteria of the respiratory tract. In most cases, the first infections take place early in the animal’s life, and most adults are immune and less susceptible to disease. Some adult cows remain carriers or shedders of the microbe and/or give partial immunity to their offspring (Prado *et al.* 2005; Jeyaseelan *et al.* 2002; Crouch *et al.* 1985, 2000; Kapil & Basaraba, 1997; Van Der Poel *et al.* 1997; De Jong *et al.* 1996; Wentink *et al.* 1993; Belknap *et al.* 1991).

This doesn’t mean that infectious respiratory disease cannot to be found in adult cows (or in adult and young cattle), for example:

- infectious disease may be discovered in few adults or youngsters suffering chronic suppurative pneumonia, reflecting an ancient disease (pasteurellosis or mycoplasmosis) unsuccessfully cured (Nicholas & Ayling, 2003; Le Grand *et al.* 2001; Pfutzner & Sachse, 1996). In this case, the onset of the illness appears suddenly after weeks or months of septic dissemination of the lung (Selman *et al.* 1977), and a new treatment, if successful, would be non-economical (Breeze, 1985).
- infectious disease may be discovered in many adults and youngsters suffering mycoplasmosis (Le Grand *et al.* 2001, 2002; Pfutzner & Sachse, 1996). In this case, various extra-respiratory signs can be noticed (Nicholas & Ayling, 2003).
- outbreaks of BRSV or IBR are possible at all ages in naïve herds (Kapil & Basaraba, 1997; Elvander, 1996).

On the opposite, non-infectious disease may seem enzootic, like fog fever, farmer’s lung disease, lungworm bronchitis. Traditional tools used for the diagnosis of infectious diseases (lung lavage/washing or trans tracheal aspiration, nasal swabs, and serology) will be of poor value, except for *Dictyocaulus viviparus*: worms can be found in the bronchoalveolar washing fluid (but not always-Scott *et al.* 1996), and a specific serological test may be of value in presence of adult worms (Ploeger, 2002).

Sporadic diseases are represented by all allergies, cauda vena thrombosis, fibrosing alveolitis, tumors and as we have seen chronic suppurative pneumonia. In most case sporadic cases are therefore diseases of the sole adults.

2.3 Chronic disorders vs. acute disorders

Main chronic disorders in adult cattle include chronic (or ancient) suppurative pneumonia/pleuritis (pasteurellosis or mycoplasmosis), fibrosing alveolitis, extrinsic allergic alveolitis, sometimes vena caval thrombosis (50% cases) and tumors (Breeze, 1985).

As usual for chronic disease, history is of great importance, including the previous treatments. As these problems involve very often a small number of animals if not a single one, prognosis seems more important than diagnosis. Decisions for culling or not are expected by the farmer in order to avoid long-term, cost-effective and frequently inefficient additional treatments.

Main acute disorders include IBR, rarely BRSV, and allergies including milk allergy, vena caval thrombosis (the other 50% cases), parasitic bronchitis, malignant catarrhal fever, fog fever, Q fever and ehrlichiosis (Peek, 2005; Holzauer *et al.* 2003; Selman *et al.* 1977). Even more so than for chronic disorders, laboratory assays are necessary for the diagnosis. These cases are among the most difficult to solve: as acute disorders in adult cows are often group problems and as they can be of various origins, various samples and laboratory assays have to be performed (feces, blood sera, blood cells, lung washing; PCR, serology, Baermann coproscopy, and so on). Sometimes the farmer can acquire a feeling of “persistent” or “chronic” disease, particularly in case of ehrlichiosis or Q fever, because of a slow evolution within the herd in multiple animals, and because some of them may relapse (Joncour, 2004).

3. FROM CLINICS TO DIAGNOSIS

As we have shown, signs of respiratory disease in adult cows vary from mild to severe. The number of affected animals varies from “one” to “many” or “most”, and clearly the number of affected animals is not correlated with the severity of the disease. We will hereafter focus mainly on enzootic disorders.

Clinical signs may be severe for contagious viral diseases, such as IBR or coronavirus infections, for pasteurellosis (pneumonia frequently associated to pleuritis) and for most laryngitis, rhinitis, anaphylaxis and tumors (sporadic or limited to individual cases). They can affect the upper respiratory tract (IBR, BVD, laryngitis, and malignant catarrhal fever...) or the lungs (*Mannheimia haemolytica*, *Pasteurella multocida*, *Actinobacillus somnus*, *Mycoplasma bovis* and *Chlamydia* spp. infections, BRSV, lungworms, fog fever, farmer’s lung...).

Respiratory signs may be associated with general symptoms, such as diarrhea (coronavirus, BVD), depression and hypertrophy of lymph nodes (malignant catarrhal fever), mastitis and arthritis (mycoplasmoses), hemoptysis (thrombosis of the *vena cava*), edema of the legs (ehrlichioses), abortion (Q fever), shock (systemic anaphylaxis).

But in many cases signs are mild if not unapparent, and signs are limited to cough, milk drop, weight losses. Clinical examination results are obviously poor and necropsy findings are as limited as the number of fatal cases. These cases are the more challenging for the vets, and it is even difficult to name them.

An increasing number of cases are reported, at least in Western Europe. For example, outbreaks of respiratory disorders in adult cattle kept in pastures are called “summer cough” (toux d’été) in

France, and they are referred to as “sporadic milk drop syndrome” in UK, but till the beginning of the 90’, few explanations could be given to this syndromes. Nasal discharge, cough, sudden drop of milk yield, anorexia and variable hyperthermia can be observed in numerous cows, and rarely in heifers. Haptoglobin rate and white cell count can be slightly modified. In most cases, signs are back to normality within one or two weeks. Very often, other cows are ill during the season and sometimes the same cows may be ill again during the same season or the year after.

In few cases, almost all cows can be ill, hyperthermia can exceed 40° C, respiratory rate can go over 60 per minute, and the course of the disease can be as long as 6 weeks and one to two cows can die. Many causes have been evocated following serological or microbiological results:

- viral causes, essentially BRSV, BVD, coronavirus, and IBR infections,
- bacterial causes (*M. haemolytica*, *P. multocida*, *A. somnus*, *Mycoplasma bovis*, *Chlamydia* spp., *Coxiella burnettii*, *Anaplasma phagocytophila* and *A. marginale*, *Leptospira* spp.),
- parasitic or fungal causes (*Dictyocaulus viviparus*, *Aspergillus* spp. *Micropolyspora foeni*, and in some cases infection by *Babesia bovis* and *B. bigemina*).

Clinical descriptions of the disease have oriented researches toward a contagious agent. The hypothesis of the involvement of the BRSV has been first evaluated:

- first descriptions of BRSV have been made in adult cows in Switzerland (Paccaud & Jacquier, 1970), Sweden (Elvander, 1996) and France (Frappier *et al.* 1986),
- herd surveys in the Netherlands have demonstrated the circulation of the virus in dairy herds all the year long and the correlation with clinical cases and milk drop (van der Poel *et al.* 1993, 1997),
- a seroconversion can be observed in adult cows facing respiratory disease (Pritchard & Fishwick, 1997),
- BRSV can act in synergy with *Dictyocaulus viviparus* or fog fever (Johnson, 1991, Verhoeff *et al.* 1988),
- in dairy cows given a BRSV vaccine prior to parturition, milk yield in the first part of lactation and conception rates are improved in certain conditions (Ferguson *et al.* 1997).

On the opposite, other arguments exist for an absence of role of BRSV in adult cows:

- clinical signs are notable only at first infection, and most of them occur in the first year of life, exceptionally at adult time (van der Poel *et al.* 1997 ; De Jong *et al.* 1996, Elvander, 1996 ; van der Poel *et al.* 1993),
- later infections are correlated with no symptoms (van der Poel *et al.* 1993).

It can be concluded that the collective respiratory diseases of adult cows cannot be very often relevant to BRSV infection. Serological surveys in milk drop syndrome have not consistently oriented to other virus; only occasionally to BVD virus, IBR virus, adenovirus 3 and 7, and in rare occasions flu virus have been identified (Hartel *et al.* 2004; Leboeuf, 2004; Graham *et al.* 2002). Coronavirus seems another candidate in Northern America, particularly in younger animals, but is poorly documented in Western Europe (Hazocksuz *et al.* 2002, 2005; Hartel *et al.* 2004; Crouch *et al.* 1985).

When chronic *Pasteurella* or *Mycoplasma* infection can be excluded, direct investigations (lung lavage, fecal examination and direct examination of blood smears) have recently oriented quite differently the diagnosis of these undifferentiated respiratory diseases: the re-emergent (or evergreen) lung worm (*Dictyocaulus viviparus*) (Ploeger, 2002) and the emergent *Anaplasma phagocytophilum* (Joncour, 2004).

Until the beginning of the 90', *Dictyocaulus viviparus* was considered a summer affection of the first grazing season ("July flu"). Epidemiological or clinical studies in UK (McKeand, 2000; David, 1997), in the Netherlands (Ploeger, 2002) and in France have revealed a dramatic increase in adult cows, with outbreaks leading to death (Holzauer *et al.* 2003). The period of disease has also enlarged, from March to December (mainly from May to November).

Lungworm can therefore be considered a major cause of respiratory disorder in any case for cattle of any age, lungworm is a re-emerging parasite (Ploeger, 2002).

Many reasons have been suggested to explain such changes in the biology of this parasite.

It must first be kept in mind that lungworm larvae are very fragile, they don't resist to dryness and cold. High levels of infestation are correlated to moist summers and autumns, and mild winter season.

Secondly, infestation is linked to the resistance level of cows. Immunity needs to be boosted regularly to be continuously efficient, and needs to be balanced with the strategy of treatment and prophylaxis of parasitism (Hoglund *et al.* 2003; Agneessens *et al.* 2000; Ploeger *et al.* 2000). The immune status of cows is unknown in the field and the identification of adult that ought to be treated remains a problem (Agneessens *et al.* 2000; Borgsteede *et al.* 2000).

In consequence, the worst conditions exist when, at the end of winter, a high level of larvae persist in pastures used by herds at low level of immunity. One must also keep in mind that lungworms can be introduced in a naïve herd by a carrier (Holzauer *et al.* 2003).

But lungworms don't seem to solve all cases of cough, milk drop and weight loss in adult cows. Recent surveys of herds with respiratory illness in cows have revealed the absence of *Dictyocaulus viviparus* in many cases observed in Western France. The number of positive diagnosis (by Baermann test) for *Dictyocaulus viviparus* was up to one third of the tested herds, but 91% for *Anaplasma phagocytophilum* (by serological test) (Leboeuf, 2004). This may be an "over diagnosis" in zones where ticks are abundant, but this tick-borne disease may be of importance in the differential diagnosis of respiratory disease in cows. One must keep in mind that ticks may be the carrier of other pathogens for ruminants too (Halos *et al.* 2006; de la Fuente *et al.* 2005a and 2005b).

4. GLOBAL SCHEME FOR ACTION

Considering respiratory disorders in adult cows, as for younger animals, the aim of the clinical examination (including *post mortem* examination) is to discover elements of diagnosis significance. History (including previous successful or unsuccessful prescriptions) and management practices will help the practitioner too.

4.1 Steps of the diagnosis

The first step will be therefore the collection of history and the knowledge of management practices and all the background of the disorder.

A careful examination of the animals will go after (extensive pathologic examination, focusing on fever, appetite, and upper or lower respiratory tract signs). If possible, all cows kept with the ill animals will be examined too with a special focus on temperature: animals at the very beginning of the disease will be detected.

The total number of affected animals (ill + incubating) will be established after this step.

The practitioner will have in mind the number of affected animals, the location of the disorder and all clinical parameters, and (among other historical parameters) the duration of the disease. Finally, four cases will be considered:

- sporadic (or individual) disorder associated with an acute evolution,
- sporadic (or individual) disorder associated with a chronic evolution,
- group disorder associated with an acute evolution,
- group disorder associated with a chronic evolution.

He will evaluate different hypothesis and will rank them from highly probable to very improbable. As seen in Table I, in each case one or two hypotheses (maximum) can be privileged.

For example, a few cases of acute pneumonia with emphysema in young adults after a pasture change will encourage the clinician to suspect fog fever; “contagious” cough and milk drop syndrome in summer will lead to suspect ehrlichiosis or lungworm infestation; important weight loss cough and fever during a “long” clinical course will lead alongside with auscultation data to suspect chronic suppurative pneumonia/pleuritis or vena caval thrombosis.

In most cases, the next step will be the laboratory examination. In order to avoid wasting the farmer’s and the vet’s time and money, the choice will be limited. For example in adult cows, serological examinations, which are of common use in bovine respiratory complex of the youngsters, are not very pertinent. For the same reasons plus the duration of the disease and the previous anti-infective treatments, lung washing will be of low interest in case of chronic suppurative pneumonia/pleuritis. Reversely, specific exploration of *Anaplasma phagocytophilum* and *Dictyocaulus viviparus* are mandatory in case of milk drop syndrome or “summer cough”.

4.2 Treatment

Treatment appears to be the main corrective measure, but measures for bio security and improvement of housing and management are not to be forgotten.

If possible, the treatment will be specific of the disorder, such as tetracycline for ehrlichiosis, anthelmintic drug for lungworm, corticosteroids for fog fever and allergies, and so on.

In some cases, as vena caval thrombosis, tumors and even chronic suppurative pneumonia/pleuritis, the treatment is impossible or it could be too expensive for a poor prognosis, and culling must be proposed.

5. CONCLUSIONS

Respiratory disorders in adult cows are a challenge for the practitioner. Multiple agents can cause mild to severe disease. A good knowledge of the background of the herd associated with careful clinical examination can lead to a probable diagnosis. A practical approach is to consider the number of affected animals (sporadic disorder or group disorder) and the acute or chronic aspect of the disorder. For each case (sporadic + acute, sporadic + chronic, group + acute, group + chronic), only few main hypotheses are highly probable. The use of laboratory examination must be reasonable, as well as the treatment prescribed, essentially because of the global cost for the farmer (number of treated animals + total weight + milk or meat withdrawal period). The accurate

prognosis will be at least as important as the diagnosis. Unfortunately, chronic or severe respiratory disorders of the adult cows may lead to culling.

6. SUMMARY

Respiratory disorders in adult cattle may have various causes. General characteristics are difficult to outline. Some of the respiratory disorders are characteristic of the adult cattle (on the contrary, some of them are common to adults and youngsters), some of them are contagious or enzootic (on the contrary, some of them are sporadic), some of them are acute (some of them are chronic), some of them induce mild symptoms, some of them induce severe if not lethal symptoms. The base of the diagnosis is a mixed epidemiological and clinical approach. Laboratory examinations and useless treatments are rapidly cost effective for the farmers. In some cases, culling is mandatory.

7. KEY WORDS

Respiratory disorders, laboratory examination.

8. RESUME

Les affections respiratoires des bovins adultes peuvent avoir de nombreuses causes. Il est difficile d'en définir des caractères communs. Certaines peuvent être particulières à l'adulte (d'autres non), certaines sont contagieuses ou enzootiques (d'autres sporadiques), certaines sont chroniques (d'autres évoluent sur un mode aigu), certaines sont accompagnées de signes discrets tandis que d'autres peuvent être sévères voire létales. Le diagnostic est fondé sur la concordance des éléments épidémiologiques et cliniques. Les analyses complémentaires et certains traitements injustifiés sont rapidement très coûteux pour l'éleveur. La réforme est parfois la seule solution médicale et économique.

9. MOTS CLES

Maladies respiratoires, examens de laboratoire.

10. RESÚMEN

Muchas causas pueden provocar enfermedades respiratorias en el ganado bovino adulto. Es difícil definir características comunes. Algunas afecciones pueden ser características de las vacas (y otras no), algunas pueden parecer contagiosas (y otras esporádicas), algunas evolucionan en un modo agudo (y otras en un modo crónico), algunas no son severas (y otras son fatales). Datos epidemiológicos y clínicos son la base del diagnóstico. Análisis de laboratorio o inútiles antibióticos pueden ser rápidamente muy costosos para el ganadero. Para algunas enfermedades, la única solución es el matadero.

11. PALABRAS CLAVES

Enfermedades respiratorias, análisis de laboratorio.

12. REFERENCES

Agneessens J, Claerebout E *et al.* Nematode parasitism in adult dairy cows in Belgium. *Vet Parasitol*, 2000; 90(1-2):83-92.

Alenius S, Niskanen R *et al.* Bovine coronavirus as the causative agent of winter dysentery: serological evidence. *Acta Vet Scand*, 1991; 32:163-170.

- Ames TR. Dairy calf pneumonia. The disease and its impact. *Vet Clin North Am Food Anim Pract*, 1997; 13:379-391.
- Anderson LJ, Sandison AT, Jarrett WF. A British abattoir survey of tumours in cattle, sheep and pigs. *Vet Rec*, 1969; 84(22):547-551.
- Anderson LJ, Sandison AT. Pulmonary tumours found in a British abattoir survey: primary carcinomas in cattle and secondary neoplasms in cattle, sheep and pigs. *Br J Cancer*, 1968; 22(1):47-57.
- Babiuk LA, Lawman MJ, Ohmann HB. Viral-bacterial synergistic interaction in respiratory disease. *Adv Virus Res*, 1988; 35:219-249.
- Belknap EB, Baker JC *et al.* The role of passive immunity in bovine respiratory syncytial virus-infected calves. *J Infect Dis*, 1991; 163:470-476.
- Berger I, Schierl R, *et al.* Concentrations of dust, allergens and endotoxin in stables, living rooms and mattresses from cattle farmers in southern Bavaria. *Ann Agric Environ Med*, 2005; 12(1):101-107.
- Borgsteede FH, Tibben J, *et al.* Nematode parasites of adult dairy cattle in the Netherlands. *Vet Parasitol*, 2000; 89(4):287-296.
- Braun U, Fluckiger M, *et al.* Diagnosis by ultrasonography of congestion of the caudal vena cava secondary to thrombosis in 12 cows. *Vet Rec*, 2002; 150(7):209-213.
- Breeze R. Respiratory disease in adult cattle. *Vet Clin North Am Food Anim Pract*, 1985; 1(2):311-346.
- Breeze RG, Pirie HM, *et al.* Pulmonary arterial thrombo-embolism and pulmonary arterial mycotic aneurysms in cattle with vena caval thrombosis: a condition resembling the Hughes-Stovin syndrome. *J Pathol*, 197; 119(4):229-237.
- Callan RJ, Van Metre DC. Viral diseases of the ruminant nervous system. *Vet Clin North Am Food Anim Pract*, 2004; 20(2):327-362.
- Callan R J, Garry FB. Biosecurity and bovine respiratory disease. *Vet Clin of North Am Food Anim Pract*, 2002:57-77.
- Chandler KJ, Barrett DC, *et al.* Dissecting aneurysm of the carotid artery as a cause of respiratory distress in adult cattle. *Vet Rec*, 2001; 149(5):144-147.
- Collins JK, Riegel CA *et al.* Shedding of enteric coronavirus in adult cattle. *Am J Vet Res*, 1987; 48:361-365.
- Crouch CF, Oliver S *et al.* Lactogenic immunity following vaccination of cattle with bovine coronavirus. *Vaccine*, 2000; 19:189-196.
- Crouch CF, Bielefeldt Ohman H *et al.* -Chronic shedding of bovine enteric coronavirus antigen-antibody complexes by clinically normal cows. *J Gen Virol*, 1985; 66:1489-1500.
- Crowe JE, Jr. Influence of maternal antibodies on neonatal immunization against respiratory viruses. *Clin Infect Dis*, 2001; 33:1720-1727.
- David GP. Survey on lungworm in adult cattle. *Vet Rec*, 1997; 141(13):343-344.
- De Jong MC, van der Poel WH *et al.* - Quantitative investigation of population persistence and recurrent outbreaks of bovine respiratory syncytial virus on dairy farms. *Am J Vet Res*, 1996; 57:628-633.
- De La Fuente J, Naranjo V *et al.* Potential Vertebrate Reservoir Hosts and Invertebrate Vectors of *Anaplasma marginale* and *A. phagocytophilum* in Central Spain. *Vector Borne Zoonotic Dis*, 2005a; 5(4):390-401.
- De la Fuente J, Torina A *et al.* Serologic and molecular characterization of *Anaplasma* species infection in farm animals and ticks from Sicily. *Vet Parasitol*, 2005b; 133(4):357-362.
- Elvander M. Severe respiratory disease in dairy cows caused by infection with bovine respiratory syncytial virus. *Vet Rec*, 1996; 138:101-105.

- Ferguson JD, Galligan DT, Cortese V. Milk production and reproductive performance in dairy cows given bovine respiratory syncytial virus vaccine prior to parturition. *JAVMA*, 1997; 210(12):1779-1783.
- Frappier E, Lucas C *et al.* Isolement d'un virus respiratoire syncytial bovin en France, étude clinique et virologique. *Rec Med Vet*, 1986; 1189-1194.
- Graham DA, Calvert V, McLaren E. Retrospective analysis of serum and nasal mucus from cattle in Northern Ireland for evidence of infection with influenza A virus. *Vet Rec*, 2002; 150:201-204.
- Halos L, Mavris M, Vourc'h G, *et al.* Broad-range PCR-TTGE for the first-line detection of bacterial pathogen DNA in ticks. *Vet Res*, 2006; 37(2):245-253.
- Hartel H, Nikunen S *et al.* Viral and bacterial pathogens in bovine respiratory disease in Finland. *Acta Vet Scand*, 2004; 45(3-4):193-200.
- Hasoksuz M, Kayar A *et al.* Detection of respiratory and enteric shedding of bovine coronaviruses in cattle in Northwestern Turkey. *Acta Vet Hung*, 2005; 53(1):137-146.
- Hasoksuz M, Hoet AE, *et al.* Detection of respiratory and enteric shedding of bovine coronaviruses in cattle in an Ohio feedlot. *J Vet Diag Invest*, 2002; 14(4):308-313.
- Hoglund J, Ganheim C, Alenius S. The effect of treatment with eprinomectin on lungworms at early patency on the development of immunity in young cattle. *Vet Parasitol*, 2003; 114(3):205-214.
- Holzhauser M, Ploeger HW, Verhoeff J. Lungworm disease in dairy cattle: symptoms, diagnosis, and pathogenesis on the basis of four case reports. *Tijdschr Diergeneeskd*, 2003; 128(6):174-178. Kindly translated by D. Vanderpoten.
- Jeyaseelan S, Sreevatsan S, Maheswaran SK. Role of *Mannheimia haemolytica* leukotoxin in the pathogenesis of bovine pneumonic pasteurellosis. *Anim Health Res Rev*, 2002; 3(2):69-82.
- Johnson B. Nutritional and dietary interrelationships with diseases of feedlot cattle. *Vet Clin North Am Food Anim Pract*, 1991; 7(1):133-142.
- Joncour G. L'ehrlichiose bovine à *Anaplasma phagocytophilum*-EGB- révélateur potentiel de l'anaplasmose humaine-AH. In: *Maladies à tiques, Entretiens de Bichat*, 2004:4-9.
- Kapil S, Basaraba RJ. Infectious bovine rhinotracheitis, parainfluenza-3, and respiratory coronavirus. *Vet Clin North Am Food Anim Pract*, 1997; 13:455-469.
- Kimman TG, Zimmer GM *et al.* Epidemiological study of bovine respiratory syncytial virus infections in calves: influence of maternal antibodies on the outcome of disease. *Vet Rec*, 1988; 123:104-109.
- Kumamoto K Uchida K *et al.* Malignant aortic body tumor in a Holstein cow. *J Vet Med Sci*, 1997; 59, 383-385.
- Le Grand D, Calavas D, *et al.* Serological prevalence of *Mycoplasma bovis* infection in suckling beef cattle in France. *Vet Rec*, 2002; 150(9):268-273.
- Le Grand D, Phillippe S, Calavalas D, Bezille P, Poumarat F. Prevalence of *Mycoplasma bovis* infection in France. In: *Mycoplasmas of ruminants: pathogenicity, diagnostics, epidemiology and molecular genetics*, Poveda JB, Fernandez A, Frey J, Johansson KE Eds, vol.5 European Commission, 2001:106-109.
- Leboeuf C. Le dictyocaulose n'est pas systématique lors de "toux d'été". *Point Vet*, 2004; 245:10-11.
- Lemaire M, Pastoret PP *et al.* -Le contrôle de l'infection par le virus de la rhinotracheite infectieuse bovine. *Ann Med Vet*, 1994; 138:167-180.
- Loneragan GH, Gould DH *et al.* Association of 3-methyleneindolenine, a toxic metabolite of 3-methylindole, with acute interstitial pneumonia in feedlot cattle. *Am J Vet Res*, 2001; 62(10):1525-1530.
- McKeand JB. Vaccine development and diagnostics of *Dictyocaulus viviparus*. *Parasitol*, 2000; 120 Suppl:S17-23.
- Matsuda K, Mochizuki T *et al.* Malignant retroperitoneal paraganglial tumour in a cow. *J Comp Pathol*, 2003; 128(1):75-78.

- Mills LL, Pace LW. Caudal vena caval thrombosis in a cow. JAVMA, 1990; 196(8):1294-1296.
- Nicholas RA, Ayling RD. *Mycoplasma bovis*: disease, diagnosis, and control. Res Vet Sci, 2003; 74(2):105-112.
- Norstrom M, Edge VL, Jarp J. The effect of an outbreak of respiratory disease on herd-level milk production of Norwegian dairy farms. Prev Vet Med, 2001; 51(3-4):259-268.
- Pastoret PP, Thiry E. Diagnosis and prophylaxis of infectious bovine rhinotracheitis: the role of virus latency. Comp Immunol Microbiol Infect Dis, 1985; 8:35-42.
- Paccaud MF, Jacquier C. A respiratory syncytial virus of bovine origin. Arch Gesamte Virusforsch. 1970; 30(4):327-342.
- Peek SF. Respiratory emergencies in cattle. Vet Clin North Am Food Anim Pract, 2005; 21(3):697-710.
- Pfutzner H, Sachse K. *Mycoplasma bovis* as an agent of mastitis, pneumonia, arthritis and genital disorders in cattle. Rev Sci Tech, 1996; 15(4):1477-1494.
- Ploeger HW. *Dictyocaulus viviparus*: re-emerging or never been away? Trends Parasitol, 2002; 18(8):329-32.
- Ploeger HW, Borgsteede FH *et al.* Cross-sectional serological survey on gastrointestinal and lung nematode infections in first and second-year replacement stock in the Netherlands: relation with management practices and use of anthelmintics. Vet Parasitol, 2000; 90(4):285-304.
- Powers JG, VanMetre DC *et al.* Evaluation of ovine herpesvirus type 2 infections, as detected by competitive inhibition ELISA and polymerase chain reaction assay, in dairy cattle without clinical signs of malignant catarrhal fever. JAVMA, 2005; 227(4):606-611.
- Prado ME, Prado TM *et al.* Maternally and naturally acquired antibodies to *Mannheimia haemolytica* and *Pasteurella multocida* in beef calves. Vet Immunol Immunopathol, 2005 (Epub ahead of print).
- Pritchard G, Fishwick J. Bovine respiratory syncytial virus infection in lactating cows. Vet Rec, 1997; 141(5):131-132.
- Pusterla N, Huder JB *et al.* Quantitative real-time PCR for detection of members of the *Ehrlichia phagocytophila* genogroup in host animals and Ixodes ricinus ticks. J Clin Microbiol, 1999; 37(5):1329-1331.
- Pusterla N, Huder JB *et al.* Detection of *Ehrlichia phagocytophila* DNA in Ixodes ricinus ticks from areas in Switzerland where tick-borne fever is endemic. J Clin Microbiol, 1998; 36(9):2735-2736.
- Rebhun WC, Rendano VT *et al.* Caudal vena caval thrombosis in four cattle with acute dyspnea. JAVMA, 1980; 176(12):1366-1369.
- Scott PR, McGorum BC, Else RW. Extensive pleural effusion associated with diffuse fibrosing alveolitis in an aged beef cow. Vet Rec, 1997; 141(5):128-129.
- Scott CA, McKeand JB, Devaney E. A longitudinal study of local and peripheral isotype/subclass antibodies in *Dictyocaulus viviparus*-infected calves. Vet Immunol Immunopathol, 1996; 53(3-4):235-247.
- Selman IE, Wiseman A. *et al.* Differential diagnosis of pulmonary disease in adult cattle in Britain. Bov Pract, 1977; 12:63-74.
- Selman IE, Wiseman A, *et al.* Fog fever in cattle: various theories on its aetiology. Vet Rec, 1976; 99(10):181-184.
- Thiry E, Saliki J *et al.* Parturition as a stimulus of IBR virus reactivation. Vet Rec, 1985; 116:599-600.
- Van der Poel WH, Langedijk JP *et al.* Serological indication for persistence of bovine respiratory syncytial virus in cattle and attempts to detect the virus. Arch Virol, 1997; 142:1681-1696.
- Van der Poel WH, Kramps JA *et al.* Dynamics of bovine respiratory syncytial virus infections: a longitudinal epidemiological study in dairy herds. Arch Virol, 1993; 133:309-321.
- Verhoeff J, Wierda A, Boon JH. Clinical signs following experimental lungworm infection and natural bovine respiratory syncytial virus infection in calves. Vet Rec, 1988; 123(13):346-350.

Wathes CM, Jones CDR, Webster AJF. Ventilation, air hygiene and animal health. *Vet Rec*, 1983; 554-559.

Wentink GH, van Oirschot JT, Verhoeff J. Risk of infection with bovine herpes virus 1 (BHV1): a review. *Vet Quart*, 1993; 15:30-33.