INTRODUCTION

Pneumonia is the second most common health problem in young calves, after diarrhea.

Respiratory infections include all diseases affecting the entire respiratory tract. In contrast, pneumonia is a term that describes inflammation of the lungs only. Pneumonia is a disease that may vary from subclinical to acute and fatal. Depending on the severity of the infection, damage to the lungs can be temporary or permanent. Calves with chronic pneumonia seldom recover completely and should not be used as replacement animals.

Most respiratory problems occur when the calf is between six and eight weeks of age. They are caused by the interaction of one or more microorganisms with stress (e.g., transport), housing (e.g., ventilation) and nutrition of the calf. Rate of morbidity (the incidence of the disease) is usually high, but the rate of mortality is variable. The major organisms implicated in outbreaks of calf pneumonia are summarized in Table 1.

ORGANISMS

Pneumonia frequently follows other infectious diseases. The organisms associated with the disease often will not cause clinical signs without the presence of predisposing factors. In other words, a healthy calf often does not become sick when infected with a particular microorganism. However, micro-organisms of different species may reinforce each other’s effects (synergistic effect). For example, calves become more severely ill when infected with both mycoplasma (e.g., M. bovis) and bacteria (e.g., *P. hemolytica*) than when infected with each agent separately. Sometimes, infections with one agent may weaken the calf’s resistance. For example, infection with bovine respiratory syncytial virus (RSV) appears to predispose the lungs to secondary infections. RSV virus damages the ciliated epithelial cells that normally clear the lungs from invading agents.

Infection by viral agents is often followed by a secondary bacterial invasion (especially by *P. haemolytica* and *C.

Table 1: Microorganisms implicated in pneumonia

<table>
<thead>
<tr>
<th>Bacteria</th>
<th>Virus</th>
<th>Mycoplasma</th>
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</thead>
<tbody>
<tr>
<td><em>Pasteurella multocida</em></td>
<td>Parainfluenza type 3 (PI3)¹</td>
<td>Mycoplasma dispar¹</td>
</tr>
<tr>
<td><em>Pasteurella hemolytica</em></td>
<td>Infectious bovine rhinotracheitis (IBR)²</td>
<td>Mycoplasma spp</td>
</tr>
<tr>
<td><em>Corynebacterium pyogenes</em></td>
<td>Bovine respiratory syncytial virus (RSV)</td>
<td>M. bovirhinis</td>
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<tr>
<td><em>Neisseria spp</em></td>
<td>Bovine virus diarrhea (BVD)</td>
<td>M. bovis</td>
</tr>
<tr>
<td><em>Chlamydia spp</em></td>
<td>Bovine adenovirus</td>
<td>Ureaplasma spp</td>
</tr>
<tr>
<td><em>Haemophilus somnus</em></td>
<td>Reovirus</td>
<td></td>
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</tbody>
</table>

¹ Microorganisms most often isolated from the damaged lungs of calves that died of pneumonia.
² Also called bovine herpes virus type 1.
pyogenes). RSV virus and adenovirus primarily infect the lower respiratory tract (lobes of the lungs). However, many micro-organisms also colonize the upper respiratory tract (nose, larynx, trachea, bronchi).

**CLINICAL SIGNS**

Although calves may not show acute signs of pneumonia until they are one month old, they may harbor and be afflicted with the micro-organisms at 1-3 weeks of age. Clinical signs are variable and generally are observed in combinations:

1) Nasal discharge (thin and watery or thick and purulent);
2) Dry cough, especially noticeable after exercise (the cough may persist even after the calf has recovered from the disease);
3) Rectal temperature above 41°C (normal = 38.6°C);
4) Lesions of the lungs;
5) Respiratory distress (difficult breathing or dyspnea);
6) Diarrhea.

**PREDISPOSING FACTORS**

Colostrum feeding (i.e., passive immunity) appears to protect calves for the first month after birth as few cases of pneumonia occur until then. The peak incidence occurs between 40 and 50 days after birth, which corresponds to a low point in the concentration of antibodies in the blood (Figure 1). In healthy calves, immunoglobulin A (IgA) is the immunoglobulin in highest concentration in the upper respiratory tract and the lungs (respiratory mucosa). However, immunoglobulin G (IgG) predominates in the lungs of infected animals. Blood serum concentrations of IgG greater than 15 g/l seem adequate to protect calves against pneumonia. Calves with reduced immune resistance or under continual assault with a large number of micro-organisms are more likely to develop pneumonia. The calf’s resistance to pneumonia may be overwhelmed more easily under feeding, housing and management techniques that are inadequate.

**Housing (building ventilation)**

Poor ventilation and high relative humidity are often associated with outbreaks of pneumonia. However, other environmental factors also have predisposing actions. For example, concentrations of ammonia and other gases from manure and decomposing bedding may irritate the lungs. Volume and velocity of air in a building affect the concentration of micro-organisms in the calf’s environment. Calves are more prone to suffer from pneumonia when they are in the following environmental conditions:

1) A poorly ventilated space where gases and microorganisms accumulate;
2) A high relative humidity combined with a low environmental temperature.

Calves with chronic pneumonia seldom recover completely and should not be used for replacement.
(cold, humid air) and to a lesser extent
a low relative humidity combined
with a high environmental
temperature (hot, dry air);
3) Large diurnal temperature variations.

Management
The following situations increase
susceptibility to pneumonia:
• Calves grouped too early and exposed
to the microorganisms coming from a
sick calf with chronic or subclinical
pneumonia;
• Calves weaned when they are not yet
eating adequate amounts of solid feed
(weaned too early);
• Calves purchased from different
sources and placed in pens together
and/or transported long distances
(stress).

Feeding
Calves fed extremely large amounts of
milk or milk replacer with high
concentrations of dry matter can achieve
rapid growth rates, but appear to be more
susceptible to pneumonia. This observation
could be due to increased urine output that
makes it more difficult to keep the calf dry,
or to a decrease in the calf’s immune
response when it is under the stress of
rapid growth.
Selenium deficiency may also be related
to high susceptibility to pneumonia;
however, experimental data are conflicting
at this time.

PREVENTION OF PNEUMONIA
The partial reduction or elimination of the
predisposing factors and the improvement
of faulty management techniques will
reduce the occurrence of pneumonia
significantly. Adequate intake of
colostrum, proper housing (dry individual
pen), good natural ventilation and
avoidance of nutritional stress are effective
ways of reducing the incidence of pneumonia. Vaccines against several of the
implicated microorganisms are available,
but they should be considered only when
specific agents have been identified. A
vaccination program relevant to agents
prevalent in an area should be planned
with the help of a veterinarian.

TREATMENT OF PNEUMONIA
When a calf becomes sick, early detection
is important in improving the likelihood of
survival. The calf should be placed in a
warm (sunshine), dry, well-ventilated
(fresh air) environment. Diarrhea and
dehydration can be treated with fluid
administration. Generally, antibiotic
treatment is aimed at reducing the effect of
secondary bacterial invasion.