TRACE ELEMENT DEFICIENCIES IN THE PATHOGENESIS OF RESPIRATORY DISTRESS SYNDROME IN THE MATURE NEWBORN CALF

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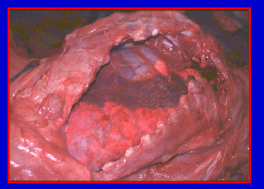
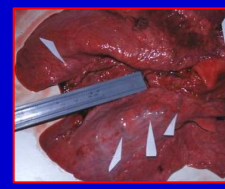
ntroduction

Belgium, respiratory distress syndrome (RDS) is one of the leading causes of neonatal death in mature hypermuscled Belgian Blue calf (BB) but also in other cattle breeds (1). Major clinical signs achypnea, tachycardia and sometimes depression) develop in the first hours after birth and are due to insufficiency of functional surfactant (2). Males are more susceptible to RDS because of the hibitor effect of testosterone on surfactant production (3). Necropsy findings reveal atelectasia, congestion, interstitial edema and emphysema. Often, intestinal lesions are also observed (1). Knowing at trace elements deficiencies can slow pulmonary maturation, the aim of this study was to investigate trace elements status in RDS affected herds in comparison with reference herds without any vidence of RDS.





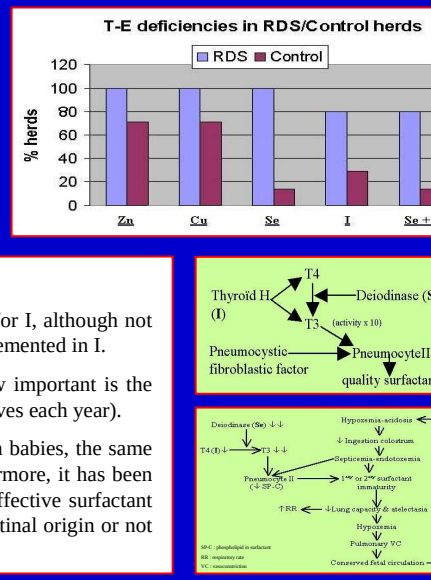
Materiel and methods

Ten RDS affected BB herds (RDS morbidity = 20-40% and mortality = 6-80%) and 7 reference herds (0% morbidity and mortality due t RDS and less than 5% due to other neonatal pathologies) were considered. In each herd, blood was sampled from 10 pregnant or freshl calved healthy cows. In each blood sample, the plasmatic zinc (Zn) and copper (Cu) contents and erythrocytic glutathion peroxydas activity (GSH-pxe) were measured and considered normal when above 15 µmol/L, 14 µmol/L and 250 IU/gHb, respectively. A herd wa deficient in one element if at least 30 % of sampled animals were out of normal range for this element. Milk was also sampled and poole from 10 calved cows or, when possible, bulk milk was taken. Milk iodine (I) content was considered normal when above 80 µg/L. Result were compared between groups by Chi-square test.

esults

ll RDS affected herds had low Zn and Cu concentrations and low GSH-pxe activity. Eight out of 10 had low I in milk. In the non-RDS affected herds, only 1 herd was deficient in I, Zn, Cu and had low GSH-xe activity, 2 herds were deficient in Zn and Cu, 1 herd was deficient in Zn, 1 herd was deficient in Cu, and 1 herd was deficient in Cu, Zn and I. RDS affected herds were significantly more often deficient in I nd GSH-pxe than non-affected herds. The thyroid of calves who died from RDS weighted 15,3-17,3 grams (normal value is 6-12 g). This increased thyroid'size revealed I deficiency in the dams.

he χ^2-test indicates significant differences between RDS affected herds and control herds for I and Se but no significant difference between RDS affected herds and control herds for Cu and Zn. Furthermore, e χ^2-test also indicates that there is significant difference between RDS and control for the combinated deficiency in Se + I. It means that the probability to meet RDS affected herds is higher with a ombinated deficiency in I and Se instead of a simple deficiency in I or in Se.



Discussion

It seems that the trace elements Se, Zn and Cu play an essential role in the development of RDS, by primary surfactant insufficiency. The same applies for I, although not deficient in all herds. The reason for this might be that milk samples were taken during lactation, when cows' nutrition was different and, in any case, supplemented in I.

A recent study (4) in Wallonian BB herds showed that the large majority (>90%) of them are deficient in at least one trace element. It can explain how important is the impact of RDS in Belgium farms. Effectively, RDS concerns 65% of the BB herds situated in the south part of Belgium (of witch 36% lose one or more calves each year).

A relation between RDS and Zn, Cu, I and Se deficiencies had been described in veterinary medicine (5,6) but also in human medicine. In mature human babies, the same RDS is observed (7) but its etiology is still unclear, although I deficiency in the mother is suspected to play a major role in its pathogenesis (8). Furthermore, it has been demonstrated that a Se-dependent deiodinase is responsible for transformation of thyroxine (T4) into tri-iodothyronine (T3) (9), which is essential for effective surfactant production (10). Another part of the pathogenesis of RDS concerns the secondary surfactant insufficiency which is due to septicemia-endotoxemia of intestinal origin or not (11, 12).

Conclusions

n conclusion, results suggest an association between RDS in mature newborn calves and trace elements deficiencies, especially Se and I, that can be responsible for primary surfactant insufficiency. Correction of trace elements deficiencies in these herds led to a pectacular decreasing of morbidity and mortality due to RDS.

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