ARTHROSIS WITH LAMENESS IN CATTLE

Prof. L Prozesky and Mr. Craig Shepstone

INTRODUCTION:

In 1982, cattle farmers and local veterinarians in the Vryburg area of the North West Province noticed a new disease, a non-infectious degenerative condition of joints now referred to as arthrosis. A normal joint surface is depicted in slide 1 and an affected surface in slide 2. Affected cattle developed visible swelling of particularly the stifle joint (femoro-tibial joint), as a result of effusions into the joints. There was lameness and poor growth and production, which could eventually lead to the affected animal being slaughtered. Post-mortem examination revealed ulceration of the joint cartilage and collapse of underlying bone (osteochondrosis).

Arthrosis initially seemed to affect only a small number of show animals, but by the mid-1990's the problem became more widespread, affecting up to 40% of some herds. All breeds, sexes and age groups are affected, in both commercial and communal herds. The condition is reported to occur throughout the North West Province and in the following areas: Cradock in the Eastern Cape; Olifantshoek in the Northern Cape; Harrismith in Kwazulu-Natal; Theunissen and Boshof in the Free State; Francistown and Lobatsi in Botswana; and Gobabis in Namibia.

FINANCIAL IMPLICATIONS OF ARTHROSIS:

The incidence of affected animals per farm varies significantly but it is estimated to be 20-30%, and in some cases up to 80% of weaner calves have been affected.

The potential production losses sustained in commercial herds are outlined in table 1, assuming a 20% reduction in growth in affected animals. Based on these figures the annual loss per farmer with 1,000 head of cattle and a calving percentage of 80% is estimated to be approximately R424,320 per annum if all the calves are sold. It is recommended that farmers replace 10-15% of their female stock per annum. On some of the farms the owners could not replace even 10% of their breeding herd annually due to the high incidence of arthrosis. In these cases breeding stock had to be purchased to maintain herd numbers. The price of a breeder is estimated to be

double the price of a commercial animal. The loss per breeding animal with arthrosis is therefore estimated to be R7103 per animal.

TABLE 1: PRODUCTION LOSSES FROM ARTHROSIS

ANIMAL	AVERAGE LIVE WEIGHT	GRADE OF CARCASS AND PRICE PER KG	TOTAL INCOME PER DRESSED CARCASS
Healthy animal	500kg	B 2-6 R19.40	R5335*
Animal with arthrosis at the same age	400kg	B0-B1 R18.20	R3567**
Loss per carcass			**R1768**

* 55% slaughtering percentage for healthy animals

** 49 % slaughtering percentage for affected animals

Losses sustained by stud farmers are much higher. The average sale price for stud bulls is currently R25,000-R30,000. Some farmers reported an incidence of up to 40% of arthrosis in their Phase D bulls, all of which had to be slaughtered, resulting in losses of R20,000-R40,000 per animal. A stud farmer recently bought a bull for R93,000. Subsequently the bull developed arthrosis and will now be slaughtered at an estimated value of R8,000.

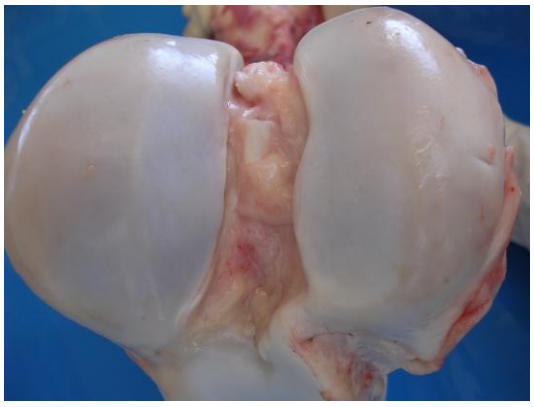

Figure 1 : Normal joint. Note the normal structure of the joint surface [cartilage]

THE DEVELOPMENT (PATHOGENESIS) AND CAUSES OF ARTHROSIS:

Osteochondrosis is a common and important joint disorder that occurs in many species, including humans, cattle, pigs, horses and dogs, and often results in arthrosis. It is defined as a focal disturbance of bone formation and has multifactoral aetiology with no single factor accounting for all aspects of the disease. A number of possible aetiologies and predisposing factors have been proposed, such as over nutrition, rapid growth, genetic predisposition, ischaemia, mineral imbalance, hormonal influences, and trauma.

In the case of cattle in North West Province the main aetiological factor is thought to be imbalances of minerals and other nutrients in the grazing and in supplements provided to cattle. The area has been known to have problems resulting from phosphorus deficiency since 1882, which were controlled by mineral supplements. In recent year's nutrient and trace element supplementation by farmers has been erratic, and the bioavailability of the minerals seems to have been inadequate. An additional factor has been the use of more sophisticated genetic selection procedures to improve the productivity of cattle in the last 15 to 20 years. Improved growth potential in calves and improved productivity of cows has altered the nutritional requirements for these cattle, but there has been no change in nutrient supplementation.

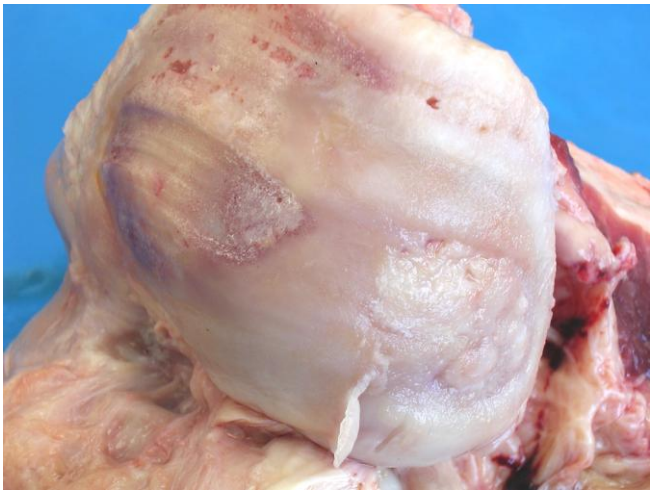

Figure 2: Joint with severe cartilage lesions

SUPPLEMENTAL FEEDING

Grazing cattle worldwide suffer mineral deficiencies and imbalances on natural pastures, due to the forages eaten not satisfying their nutrient requirements. With the exception of salt, phosphorus (P) is normally the most deficient mineral in summer veld. Other elements likely to be lacking in grazing are calcium (Ca), sodium (Na), cobalt (Co), copper (Cu), iodine (I), selenium (Se) and zinc (Zn). In some regions magnesium (Mg), potassium (K), iron (Fe) and manganese (Mn) may be deficient. Excesses of the following trace minerals can be detrimental to grazing ruminants: fluorine (F), molybdenum (Mo) and selenium (Se). To correct excesses and deficiencies to achieve profitable cattle production, it is necessary to provide livestock with well balanced mineral supplements. The principal way by which cattle producers attempt to meet the mineral requirements of grazing animals is through the use of free-choice dietary minerals (licks).

To evaluate a lick, it is necessary to have the following information: (1) cattle requirements for the essential nutrients, (2) age, stage of production or reproduction cycle, and management system (e.g. ranching, feedlot); (3) the relative bioavailability of the minerals in the sources from which the licks will be produced; (4) approximate daily intake per head of the lick and the total dry matter intake that is expected for the target animals; (5) the concentration of the essential minerals in the lick.

The greatest disadvantage of licks is the lack of uniform consumption by individual animals. Factors influencing consumption include amongst others; soil fertility, pH of soil, forage type, season of year, availability of energy and protein, individual animal requirements, salt content of water, palatability, availability of fresh minerals and physical form of minerals.

Trace Mineral Supplements

Trace minerals have traditionally been included in animal supplements as inorganic salts. However, lately more chelated or organic trace minerals have been introduced into ruminant diets (Spears, 1996). Mineral elements exist in many chemical forms, including sulphates, carbonates, chlorides, oxides and organic forms (e.g. amino acid complexes). The form chosen for use should depend on its biological value or

bioavailability, cost, availability, stability and effect in the type of diet used. It is important not to use mineral salts in the same lick that are known to react with each other.

If the mineral mix (lick) is fed free choice, the characteristics of the finished product will most likely be different from that used as a supplement in a complete diet. The nutritionist formulating the lick needs to keep the following in mind, concerning the various ingredients: biological availability, compatibility, toxicity, solubility, hydroscopicity, relative particle size, density, chemical stability, moisture and nutrient content.

Biological Availability of Mineral Sources

Chemical analysis of a feed does not provide information on the biological availability of the element for animals. The biological availability can be defined as the portion of the mineral that can be utilised by the animal for its bodily need.

Dietary factors that influence the biological availability of trace minerals are: (1) the association of minerals with the fibre fraction of feedstuffs and/or (2) binding of minerals to undigested fibre constituents in the gastrointestinal tract, (3) rumen Ph being slightly acidic (6.0–6.8), thus keeping many trace minerals in an insoluble form, (4) antagonistic interactions between minerals of similar chemical properties and size, and the formation of metal complexes in the rumen.

Organic Minerals – Mineral Chelates and Complexes

Several mineral chelates are available on the market. The use of certain organic trace mineral complexes or chelates has increased performance (growth and milk production), carcass quality and immune response. Trace minerals sequestered as amino acid or polysaccharide complexes have the highest biological availability and also have increased stability and solubility. These mineral forms do not interact with vitamins or other ions, thus being effective at lower levels, e.g. in the case of high dietary Mo, Cu in chelated form would have an advantage over an inorganic form as it might escape forming copper thiomolybdates in the digestive system from the elements Mo, Cu and sulphur (S).

RESEARCH ON ARTHROSIS

The Onderstepoort Faculty of Veterinary Science, University of Pretoria, has initiated and completed a number of trials related to the arthrosis problem. Initially donated cattle suffering from arthrosis from the affected areas were examined pathologically. The investigation revealed that the cattle suffered from osteochondrosis. Secondly a feed trial was conducted at the experimental farm Armoedsvlakte, where four different phosphate sources were compared. Thirdly an on-farm trial in the Vryburg area comparing different forms of bone meal and rock phosphate was successfully completed; the licks contained bone meal, ostrich bone meal and different phosphate sources. Liver and bone analysis were done on a number of the animals in each of the above mentioned trials. The analysis revealed that there is a problem in the absorption of both macro and trace elements from the digestive tract, most probably due to negative interactions of the elements with each other in the rumen, preventing post rumen absorption.

The University of Pretoria approached various scientists to assist with the interpretation of the results, and to formulate a lick that could prevent arthrosis and, particularly in younger animals, promote healing of affected joint tissue. The formulation was based on the hypothesis that poor bioavailability of particularly phosphorus and/or essential trace minerals is the main reason for arthrosis to develop.

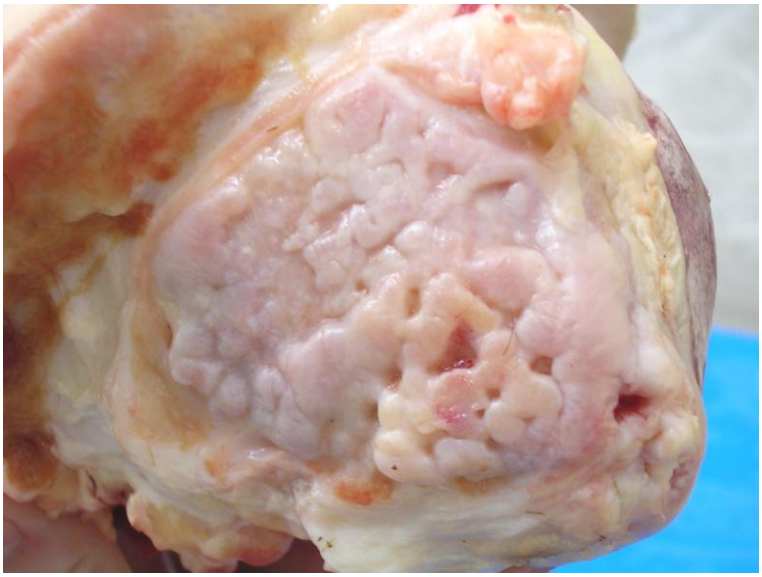

Figure 3: Note the healing of the cartilage lesions in an animal that received the improved lick.

ARTHROSIS LICK

Based on the research results to date, the research team has formulated a mineral supplement that is currently being registered under Act 36 under the name “Arthrocure. Various feed manufacturers are currently licensed by the University to use Arthrocure in their licks, with the prerequisite that the phosphorus source used comply with specifications outlined by the University. We are convinced that if a balanced lick using Arthrocure as mineral supplement and an approved phosphorus source is used, the animals are injected biannually with vitamin A and E, and proper lick management is maintained, the incidence of arthrosis will be reduced substantially and eventually the condition will be eradicated (figure 3). Further more, the lick will significantly improve the health of the animals in general resulting in amongst other high fertility and therefore calving percentage.

It is intended to continue with the research for another two years, during which time the lick will be adjusted based on results from clinical observations and analysis of liver and bone samples from cattle exposed to the lick. Approximately 4,000 head of cattle will be evaluated quarterly and lick intake measured. Furthermore, mineral analysis of liver and bone samples will be done as well as soil, grass and water analysis as outlined in the protocol attached as addendum A.

Preliminary results are very encouraging with a significant reduction of the incidence joint lesions particularly in young animals.