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OSTEODYSTROPHIA FIBROSA IN NATIVE EGYPTIAN GOATS

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SUMMARY

Clinical , radiographic , biochemical and pathologic features of osteodystrophia fibrosa were described in nine native Egyptian goats of different ages (1/2-3 years) . Affected goats were presented to the Surgery Clinic, Faculty of veterinary Medicine , Cairo University . The affected animals were suffering mainly from being off-food together with a visible bilateral , soft , nonpainful swelling of the maxilla and /or mandible . Radiography of the affected goats revealed generalised loss of bone density involving both cortical and cancellous bone tissue , with thin cortices . Widespread areas of rarefaction particularly in the mandible were present . Serum biochemical evaluation showed increased alkaline phosphatase, alanine aminotransferase (ALT) , asparatate aminotransferase (AST), urea and creatinine with low calcium and phoshcrus levels . Osteodystrophia fibrosa was confirmed histologically .

INTRODUCTION

Osteodystrophia fibrosa is seen in several non-ruminant species including the dog , cat , pig and in horse and its relatives (Krook ,1968 ;Jubb et al., 1985 ; Hungerford , 1989 ; Yates et al.; 1990 ; Radostits et. al., 1994) . In ruminants , it is most commonly observed in goats and occasionally in cattle and sheep (Saha et al., 1973 ; Andrews et al.,1983 ; Jubb et al., 1985 ; Smith , 1990 ; Matthews , 1991 ; Rodostitis et al., 1994 ; Smith & Sherman 1994) . It is a known condition in goats and this is mainly referable to imbalance of calcium and phosphorus and results from a secondary calcium deficiency due to prolonged feeding of rations with high phosphorus contents , particularly concentrates such as grain and grain products (Saha et al., 1973 ; Hungerford , 1989 ; Matthews , 1991; smith & Sherman 1994) .

Osteodystrophia fibrosa is characterized by a marked bilateral soft swelling of bones of the face and jaw , intermittent lameness , stiffness , weight loss and difficulty in prehension and mastication (Saha et al., 1973; Andrews et al., 1983; Matthews , 1991; Smith & Sherman 1994) .

CASE HISTORY AND CLINICAL EVALUATION

Nine indigenous Egyptian goats (5 males and 4 females) of different ages (1/2 - 3 years) were admitted to the Surgery Clinic , Faculty of Veterinary Medicine , Cario University , from October , 1992 to June , 1995 , with the history of gradual enlargement of the head . The above change was noticed by the owner about 45 days back . The inquiry about the ration failed to reveal the correct daily diet of the animals . Concentrates , however, were understood to be highly in use .

Clinically the condition was characterised by ina-

bility of the affected goats to close their mouths completely and there was constant protrusion of the tongue with frothy discharge from the mouth . Animals showed difficulties in prehension and mastication . Goats were in poor condition (weight loss and stiffness) with detectable bilateral , soft , nonpainful swelling of maxilla and /or mandible (Fig . 1) . Rectal temperature was 39.2 ^{o}C , with a heart rate of 117 per minute and respiratory rate of 39 per minute . The affected animals showed complete rumen atony (Table 1).

RADIOGRAPHIC EVALUTION

Radiographs of the skull , radius , carpal joint , metacarpal and digital region of the affected animals were taken . Widespread areas of osteolysis and rarefaction of the mandible with signs of floating teeth (loss of lamina dura) were observed (Fig . 2) . The radiographic survey demonstrated generalized loss of bone density especialy in the width of the cartical shadow . The shafts of the radius , metacarpus and proximal phalanx showed thinning of the cortices .

Radiographs of the carpal joint revealed an enlargement and widening of the distal epiphyseal plate of the radius . The enlarged metaphysis tended to overlap the epiphyseal plate . There was also lipping of the epiphysis (Fig.3) .

LABORATORY EVALUATION

Biochemical findings (Table 2) revealed significant increased alkaline phosphatase , ALT,AST urea and creatinine levels with significant low calcium , phosphors and albumin levels .

GROSS PATHOLOGIC FINDINGS

A male goat suffered from terminal stage of fibrous osteodystrophy, died 14 days after entry . Specimens of maxilla , mandible , ribs and sternum were taken for histopthological examination .

Post mortum examination revealed that the lesions were mainly restricted to the bony skeleton especially mandible and maxilla . Affected bone was soft , rubbery and could be cut easily with a

Table (1) : Mean values of temperature , heart rate , respiratory rate and ruminal movements in normal and affected goats

	Temperature (^{o}C)	Heart rate (per minute)	Respiratony rate (per minute)	Ruminal movements (per2 minute)
Control-Values Φ	39.000 ± 2.725	95.00 0 4.156	19.000 3.514	2.0
Affected goats	39.200 ± 1.976	117 * ±10.561	39.0 ** ±5.152	0.0

* $P < 0.05$

** $P < 0.01$ Φ Apparently healthy nine native Egyptian goats.

Table (2) : Mean values of serum bioehemical findings in normal and affected goats.

	Calcium (mg/dl)	Phosphorus (mg/dl)	Calcium/ Phosph . ratio	Sodium (meq/l)	Potassium (meq/l)	Alkaline Phosphatase (K.&K./dl)	ALT (IU/ml)	AST (IU/ml)	Total Protein (gm/dl)	Albumin (gm/dl)	Urea (mg/dl)	Creatinine (mg/dl)
Control	10.600	5.000	2.120	140	4.000	8.900	28.000	37.000	8.750	5.600	24.700	1.000
Values	± 0.420	± 0.120	± 0.270	± 5.615	± 1.325	± 1.620	± 5.412	± 3.561	± 1.26	± 0.314	± 3.572	± 0.136
Affected	8.466*	3.522*	2.403	151.420	4.400	13.400**	46.125**	46.870*	6.900	3.740*	48**	1.953
goats	± 0.311	± 0.225	± 0.268	± 7.340	± 0.235	± 1.152	± 3.154	± 3.760	± 0.314	± 0.125	± 4.145	± 0.123

* P < 0.05
** P < 0.01

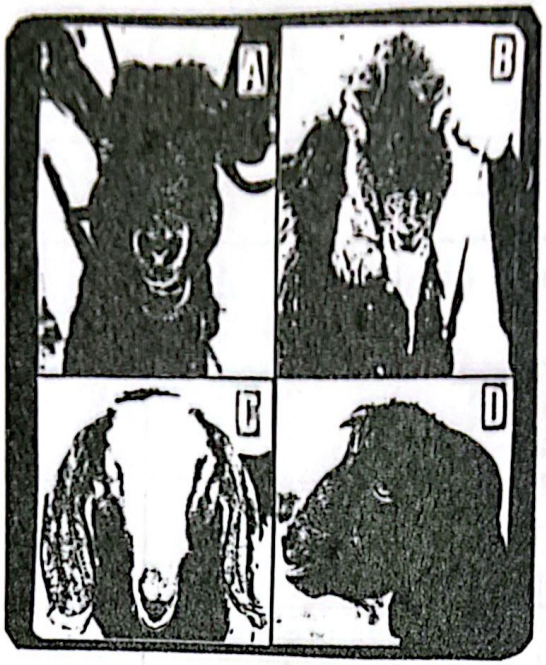

Fig . 1 : A) Front view : showing bilaterally swollen mandible and maxilla .
B) Front view : showing unilaterally swollen mandible .
C) Front View : showing bilaterally swollen maxilla .
D) lateral view : showing a goat unable to close the mouth completely .

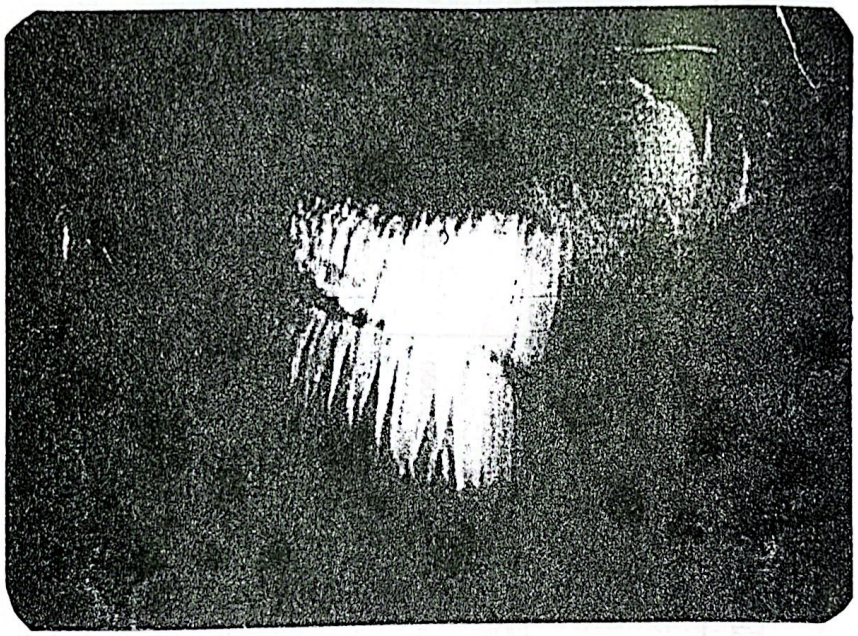

Fig . 2 : Lateral view of the skull showing areas of rarefaction and osteolysis, loss of lamina dura and marked cortical thinning of all the bones of the skull .

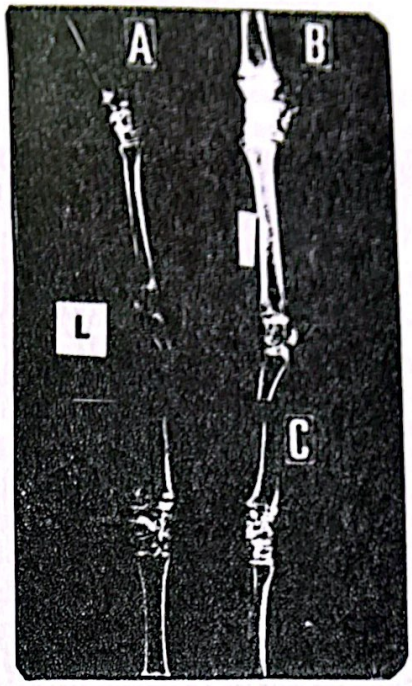

Fig . 3 : Radiograph of the radius , carpal joint , metacarpus and proximal phalanx (Lateral view & Anteroposterior view) showing thinning of the cortex and widening of medullary cavity (A),widening ,broading and lipping of the distal epiphyseal plate of the radius (B), enlarged metaphysis tended to overlap the epiphyseal plate (C) .

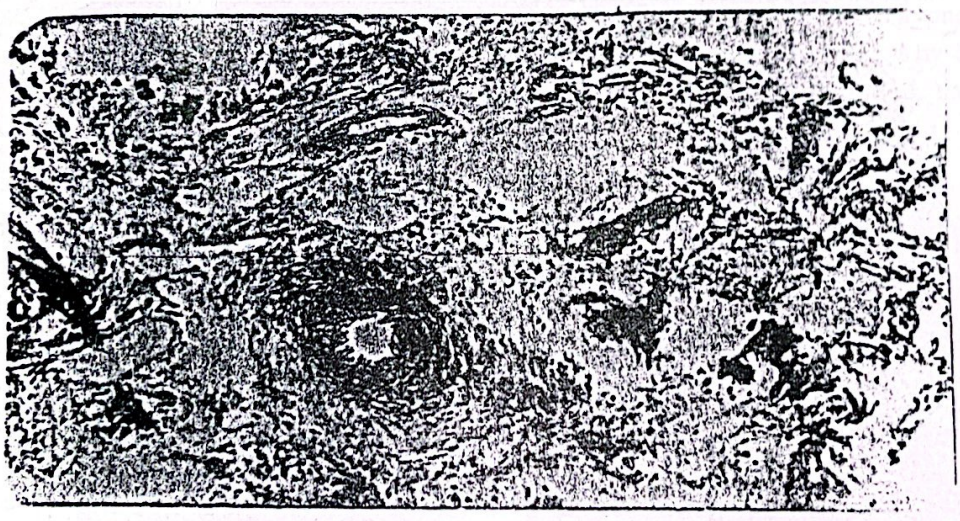

Fig . 4 : Mandible showing presence of irregular poorly calcified bony speicules (H&E, × 100) .

Fig . 5 : Mandible showing fibrous connective tissue proliferation (H&E, × 200).

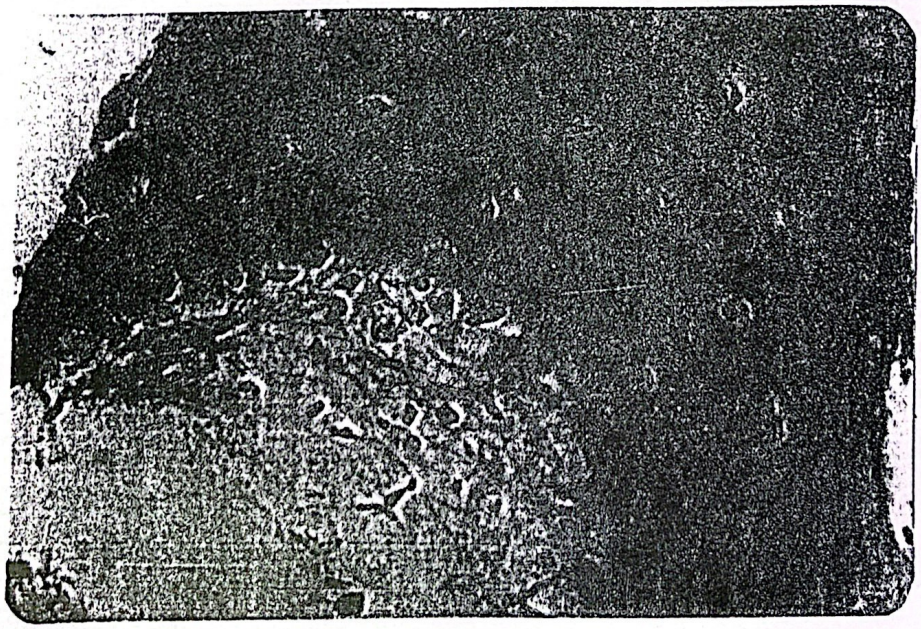

Fig . 6 : Maxilla showing osteoid tissue (H & E, × 400) .

knife .The gross soft enlargement and distortion of the mandible was evident . The teeth were loosened . Ribs were rubbery and flexible . No gross abnormalities were found in other organs .

HISTOPATHOLOGICAL FINDINGS

Bone biopsies from mandible and maxilla using bone biopsy needle as well as bone specimens were taken and fixed in formalin 10%; decalcified in chelating agent according to Culling, 1974; dehydrated; cleared and embeded in paraffine . Sections were cut 4-5 microns thick and stained with Haematoxylin and eosin (Culling, 1974) .
The histopathological examination of bone and specimens revealed replacement of marrow and cortex with irrgular spicules of poorly calcified bone (Fig.4) supported by a fibrous connective tissue stroma (Fig.5). In addition to the presence of active osteoblasts in attempt to replace the lost bone by osteoid tissue which fails to mineralize; active osteoclastic and osteolytic resorption represented by increased number of osteoclasts (Fig.6) .

DISCUSSION

The condition of osteodystrophia fibrosa in goats has been reported on several occasions (Saha et al.,1973; Andrews et al.,1983 ; Jubb et al., 1985' Hungerford ,1989; Hazarika et al., 1991; Matthews et al., 1991; and Smith & Sherman 1994). Clinical symptoms, radiographs, necropsy lesions and histopathological findings in this study were similar of fibrous osteodystrophy as has earlier been mentioned in affected goats .

The most common clinical signs of the affected goats were difficulty in eating and drinking with saliva dropping . Resorption of alveolar bone results in loose teeth , which may be dislodged easily and interfere with mastication . As a result of resorption of bone of the maxilla and mandible , bones became softened and pliable and the jaws failed to close properly , resulting in protrusion of the tongue and depraved appetite . This was concurrent with that described by Smith et al., (1974);Andrews et al., (1983); Smith et al., (1984); and Fraser et al., (1991) .

A marked bilateral enlargement and softening of the mandible and maxilla of the present cases resulted from resorption of cancellous and cortical bone , together with a partial replacement of bone with an irregular loose fibrous connective tissue surrounding a poorly mineralized bony trabeculae .This result coincides with that obtained by Runnells et al., (1967); jubb et el., (1985); Doige (1988); Hungerford (1984); Smith (1990); Naylor (1991); and Smith &Sherman (1994).

It seems that the enlargement of the mandibles and maxillae in addition to ribs abnormalities of the affected goats causes respiratory distress resulting in tachycardia and tachypnea , and this result agrees with that obtained by Saha & Des (1973); Jubb et al., (1983); and Yates & Hunt (1990) .

The affected animals showed complete ruminal atony, and that might directly be related to an inadequate supply of calcium for smooth muscle contraction as mentioned by Naylor (1991). Regarding to age susceptibility , all ages are susceptible when weaned as stated by (Saha & Des, 1973; Andrews et al., 1983; and Smith & Sherman ,1994); this coincides with the ages of the present cases .

Radiographic diagnosis of the condition in the present cases is based on radiographic evidence of generalised loss of bone density involving both

cortical and cancellous bone tissue in all bones especially of the mandible and maxilla . This is usually due to disturbed serum calcium and phosphorus levels . This confirms the previous observation of krook , (1968); Saha & Des (1973); Smith et al., (1974) ; Morgan , (1981); Andrwes et al ., (1983); Mahin et al., (1984) ; Burk et al., (1986); Smith (1990); Hazarika et al., (1991); Radostits et al., (1994); and Smith & Sherman, (1994); although Spelce, (1983); and Hungerford (1989) mentioned that radiographic examination of the affected animals with fibrous osteodystrophy is of diagnostic importance only in rather advanced cases and negative radiographic findings do not exclude the disease . A more frequent lesion of the jaws in the affected goats is loss of the lamina dura in radiographs due to resorption of the aveolar bone around the teeth . The disappearance of the bony socket causes the teeth to appear as if they are "floating" , this cofirms the findings of jubb et al.,(1985); Burk et al., (1986); and Myer ,(1986) .

The condition of osteodystrophia fibrosa in goats described by the authors is biochemically characterised by elevation of serum alkaline phosphatase level with low calcium and phosphorus levels . The resgistered hypophosphatemia in the sera of the examined animals contradicts the results of Mahin et al., (1984); Matthews (1991) and Naylor (1991), however Smith and Sherman (1994) stated that hypophosphatemia does not rule out the condition of fibrous osteodystrophy. These findings denote that the collected cases of osteodystrophia fibrosa might be at a progressive stage of the disease, by which considerable variations has been noticed, depending on the stage of the disease and the compensatory mechanism of the body (Krook, 1968 and Fraser, 1991). Prolonged stimulation of bone resoption leads to increase of serum alkaline phosphatase activity and bone rarefaction (Coles 1974; Yates et al., 1990); but Radostitis et al., 1994; stated that serum alkaline phosphates level may be increased in the prescence of increased bone resorption.

It can be said that osteodystrophia fibrosa in the goat is more or less a result of inbalanced calcium / phosphorus ratio, which should be considerable in the ration of the animnal.

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REFERENCES

Andrews, A.H., Ingram, P.L., and Longstaffe, J.A. (1983) : Osteodystrophia fibrosa in young goats . Vet. Rec. 112, 404-406 .

Baxter, J.T. (1986) :Deficiencies of Mineral Nutrients. In : Current Veterinary Therpy-Food Animal Practice 2, 1st ed . edited by Howard, J.L., Philadelphia, W.B.Sauders Company P.279 .

Burk, R.L., and Ackerman, N. (1986) :Nutritional and metabolic-Hyperparthyroidism (Primary,Secondary), Pseudohyperparathyroidsm. In: Small Animal Radiology - A Diagnostic Atlas and Text, 1st ed., New Yourk , Churchill Livingstone Inc . p 272 .

Coles, E.H. (1974): Nutritional secondary hyperparathyroidism . In : Veterinary Clinical Pathology, 2nd ed. Philadelphia, W.B. Saunders Company pp. 324-325 .

Culling , C.F.A. (1974) :Handbook of histopathological and histochemical techniques, 3ed ed., Butterwoth, London .

Doige, C. (1988): Metabolic bone Disease (fibrous

osteodystophy) . In : Special Veterinary Pathology, 1st ed. Edited by Thomson. R.G., B.C.Decker Inc .

Fraser, C.M., Bergeron ,J.A., Mays ,A., and Aiello ,S.E. (1991) : The merck veterinary manual- A handbook of diagnosis ,therapy ,and disease prevention and control for the veterinarian, 7th ed. Merck & Co., Inc . Rahway N.J., U.S.A .pp. 482-486 .

Hazarika ,G.G., Pandey , N.N., and Bhargava, A.K. (1991) :Bone radiograph profile in experimental chronic hypocalcaemia in goats . Indian Journal of Animal Sciences 61 (3) : 290-291 .

Hungerford ,T.G . (1989) : Osteodystrophia fibrosa in dogs , cats , goats and horses . In : Diseases of livestock , 8th ed . McGraw-Hill Book Co . New York and London pp . 636-637 .

Jubb , K.V.F . ,Kennedy , P.C. , and Palmer , N. (1985) : Pathology of Domestic Animals ,Volume 1 ,3rd ed. New York , Academic Press , Inc. pp. 45-50 .

Krook ,I . (1968) : Dietary calcium-phosphorus and lameness in the horse . Cornell Vet . VIII , 59 -73 .

Mahin , L . , Chadli , M . , and Marzou , A . (1984) : Osteodystrophy in growing Lambs fed a diet rich in wheat bran Vet . Rec . 115 (14) 355-357 .

Matthews ,G.J. (1991) :Osteodystrophia fibrosa . In : Outline of clinical diagnosis in the goat , 1st ed., London , Lea & Febiger p . 90 .

Morgan , J . P . (1981) :Radiology of skeletal disease - Principles of diagnosis in the dog, 1st ed., The Iowa State University Press . Ames, IOWA .

Myer ,W.(1986) : Axial skeleton Companion animals - Alterations in radiographic opacity . In: Textbook of veterinary Diagnostic Radiology, 1st ed., Edited by Thrall,D.E., Philadelphia , W.B. Saunders Company pp . 25-26 .

Naylor ,J.M . (1991) : The major minerals (Macrominerals) . In : Large Animal Clinical , Nutrition, 1st ed., E. dited by Naylor ,J.M., and Ralston ,S.L., Mosby Year Book , Inc pp.40-49 .

Radostits ,O.M., Blood , D.C., and Gay ,C.C . (1994) : Osteodystrophia Fibrosa . In :Veterinary Medicine, A Textbook of the Diseases of Cattle , Sheep , Pigs , Goats and Horses , 8 th ed., Edited by Radostits O.M., Blood ,D.C., and Gay ,C.C., El - BS with Bailliere Tindall pp .26- 27 .

Runnells , R.A., Monlux , W.S., and Monlux , A.W. (1967) : Principle of Veterinary Pathology, 1st ed., The Iowa state university press , Ames , IOWA , U.S.A .

Saha , A.C., and Des S . K . (1973) :Osteodystrophia fibrosa in a goat . Indian veterinary journal 50: 14 - 17 .

Smith , H.A., Jones , T . C . , and Hunt , R . D . (1974) :Fibrous osteodystrophy . In : Veterinary Pathology, 1st ed., Philadelphia , Lea & Febige pp . 1063 -1067 .

Smith , P.B.(1990) :Large Animal Internal Medicine- Diseases of Horses ,Cattle , Sheep , and Goats, 1st ed., philadelphia , The C.V. Mosby Company .p. 716 .

Smith , M.C., and Sherman , D.M. (1994) : Fibrous osteodystrophy . In : Goat Medicine, 1st ed., philadelphia , Lea and Febiger pp . 101 - 102 .

Spence ,J.A. (1983) : Osteodystrophic Diseases . In : Diseases of sheep, . 2nd ed., Edited bt Martin ,W.B., Oxford ,U K ; Blackwell Scientific Pubications . pp . 111-115

Yates , D.J. and Hunt , E . (1990) : Disorders of calcium metabolism . In : Large Animal Internal Medicine, 1st ed., Edited by Smith , B.P., Philadelphia , the C . V . Mosby Company . pp 1320-1321 .