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RADIOGRAPHICAL STUDY ON THE FUSION OF THE OSSIFICATION LOCI OF THE BONES OF THE ELBOW JOINT IN BALADY CATTLE

(With one Table & 10 Fig.)

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دراسة اشعاعية عن اتحاد أماكن التمعظم في عظام مفصل المرفق في البقر البلدى

نبيل مسك ، مجدى سليم ، على منصور
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أثناء التصور الجنينى للمولود لوحظ وجود خمسة مناطق تتمعظم في عظام مفصل المرفق وتشمل منطقة تمعظم لنهاية الكردوس السفلي للعضد والتي تتحد عند عمر ٢٢ أسبوع ومنطقة تمعظم الفوق لقمي الانس والتي تتحد عند عمر ٢٥ شهر . ومنطقة تتمعظم الكردوس العلوى للكعبرة فى عمر ١١ شهر . ومنطقة تمعظم الكردوس العلوى للزند فى عمر ٤٨ شهر . ومنطقة تمعظم الفوق لقمي الوحش للعضد والذي لم يستطاع رؤيته .

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SUMMARY

During the postnatal development the radiographic pictures of the bones of the elbow joint show that there are five ossification loci which are; the ossification locus of the Distal epiphysis of the humerus which is fused at the age of 32 weeks, the ossification locus of Medial epicondyle of the humerus which is fused at the age of 25 Months, the ossification loci of the proximal epiphysis of the radius which fused at age of 11 months, the ossification loci of the proximal epiphysis of the ulna which is fused at the age of 48 months, and the ossification loci of the lateral epicondyle of the humerus which could not be traced.

Keywords: Radiography, bones, elbow joint, cattle

INTRODUCTION

Historically, food animal medicine has been limited to some degree by economic factors which often indicate simplified diagnostic procedures and treatment (SHIVELY et al., 1979). On the other hand, bovine radiology was the most neglected and least explored area of veterinary radiology. This may be due to the expensive use of radiology in bovine practice and also from the commercial point of view an alternative has always existed, as it was considered more profitable to slaughter cow or steer than to undertake the expense of radiology for exact diagnosis (URI BARGAI et al., 1989).

Over the last several years changes have taken place both in economics of bovine farming especially after the use of artificial insemination and embryo transfer techniques and in the field of radiology where the portable units are now available in making the use of radiology in bovine medicine practical and feasible procedure (SHIVELY et al., 1979 and URIBARGAI et al., 1989).

Anatomical studies of bovine ossification loci have been reported in a very limited number of specimens and mostly of pre- and neonatal bovine. Some radiographic locations of epiphyseal union of long bone have been described in Egyptian buffalo (EMARA, 1937). Moreover the line drawing illustrations of the radiographs have been used to determine these locations in some joints of calves (BURT et al., 1968).

The accurate determination of the fusion time helps the animal production professions to ascertain normal growth rate and establishment of age in particular breed (JANI et al., 1994).

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1983) It is also necessary to prevent confusion of fractures with the radiolucent growth plate (MACLALLUM, 1978).

The aim of this work is to study the time of fusion of the ossification loci of the bones of the elbow joint in native cattle.

MATERIAL and METHODS

This work was carried out on six newborn native female calves and ten adult cows aged 2.5 - 8 years. The animals belong to the Department of Surgery, Faculty of Veterinary Medicine, Assiut University. The animals were housed in open stable and hand fed on standard diet. The sire of the six calves is the same and the data of birth of each one is known.

The animals were radiographed using a mobile X-ray Machine and screen film. Each animal was radiographed in recumbent position and mediolateral projections of the right elbow joint were taken.

The newly born calves were radiographed at birth then, every two weeks till six months old, after that every one month till two years old.

The ten adult cows were radiographed at different ages as shown in table 1.

The different ossification loci of the bones of the elbow joint were studied in different ages to determine the time of fusion of each locus.

The anatomical nomenclatures used in this work was that adopted to NAV (1983) and SMALLWOOD *et al* (1992).

Table (1)

No.	Age
1	2 years & 3 months
2	2 years & 6 months
3	3 years
4	3 years & 4 months
5	3 years & 7 months
6	3 years & 8 months
7	4 years
8	6 years
9	7 years
10	8 years

RESULTS

From the anatomical point of view the elbow joint is formed between the distal extremity of the humerus and the proximal extremity of the radius and ulna. Therefore the ossification loci Fig.1, a,b,c,d,e which are observed during the interpretation of the lateral radiographs of the elbow joint of one day old native cows are as follow; (a) Distal epiphysis of the humerus. (b) Medial epicondyle of the humerus (c) proximal epiphysis of the radius and (d) proximal epiphysis of the ulna (e) lateral epicondyle of the still unfused. At birth all the aforementioned loci are still unfused.

The time of the fusion of the ossification loci.

(a) Distal epiphysis of the humerus.

At birth the epiphyseal line appears as an irregular radiolucent line(Fig. 1-a). This line becomes narrow at 18 weeks old (Fig. 2-a) and complete fusion occurred at 32 weeks old (Fig. 3-a).

(b) Medial epicondyle of the humerus.

A radiograph of 12 months old shows an irregularity in the space between the medial epicondyle and the diaphysis of the humerus (Fig.4-b). This irregularity increased at 19 months old and the space becomes narrower (Fig.5-b). Later on at 25 months old the space disappear and complete fusion and ossification occurs (Fig.6-b).

(c) Proximal epiphysis of the radius.

At 9 weeks old. The radiograph shows that the epiphyseal line of the proximal epiphysis of the radius becomes narrower especially caudally (Fig.7-c). The narrowing of the epiphyseal line increased at 20 weeks old without fusion. At 24 weeks some white lines appeared and demarcate the area of fusion. At 32 weeks the white lines become clear with the result that an incomplete fusion occurred (Fig.3-c). At 11 months old the radiograph shows complete ossification of this locus (Fig.8-c)

(d) Proximal epiphysis of the ulna.

At birth the radiograph shows that the proximal epiphysis of the ulna is separated from diaphysis by a very wide epiphyseal line Fig.1-d). At 12 months old an irregularity and narrowing was observed (Fig.4-d).

At 25 months the radiograph in (Fig.6-d) shows the appearance of a white line proximal to the very narrow epiphyseal line which incompletely fused cranially. At 40 months old another irregular white line appears distal to the previous

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one. The two lines meet together caudally while the fusion is still incomplete caudally (Fig.9-d).

At 48 months old the aforementioned two white lines are replaced by one thick white line which indicates complete fusion of this locus (Fig.10-d). This thick white line gradually absorbed and disappeared, its colour becomes greyish at 72 months old, then it become thin at 78 months old and completely disappear at 84 months old except a small remnant at the most cranial point of the bone.

(e) Lateral epicondyle of the humerus.

This locus (Fig.1-e) could be seen on lateral radiographs from birth until 18 months old, later on it could not be traced in the mediolateral radiograph.

DISCUSSION

Interpretation of radiographs of the joint necessitates not only knowledge of anatomical structure but also an understanding of the course of ossification to help the veterinarian to diagnose pathological conditions of the skeleton (HERTSH and JANI *et al.*, 1983).

Since radiography is one of the most useful tools available for making a clinical evaluation of the osseous system, it is therefore essential that information in the form of easily accessible standards should contribute towards making an accurate radiographic interpretation (MAC CALLUM, *et al.*, 1978). For example, the olecranon, which is the proximal epiphysis of the ulna, is found subcutaneously at the caudal aspect of the elbow. In that position, it comes in contact with the ground when the cow is in a sitting position. Trauma to the olecranon may result in epiphyseal fractures (URI BARAGAI *et al.*, 1989).

The interpretation of radiographs may often provide supportive rather than definitive evidence. In the present study of ossification loci in the elbow joint of native cow from birth to 8 years, this was the situation regarding the interpretation of the lateral radiographs of the elbow.

The ossification loci around the elbow joint in bovine were previously enumerated (BURT, 1968 and FLORA and LINDSAY, 1969).

The five ossification loci are trochlea humeri, epicondylus medialis, epicondylus lateralis, caput radii and tuber olecrani can be visualized on the mediolateral projection, except the epicondylus lateralis appeared only at young age on the lateral view. It appeared when viewed on the postero-anterior view (BURT, 1968).

Many investigations have already reported on the secondary ossification centres in several experimental animals. It is considered, therefore, that these published data are not sufficient to be used in comparison of bone development in several animal species (FUKUDA and MATSUOKO, 1979).

Reference to previous literature indicates that only very limited studies of the ossification programme of the prenatal and neonatal bovine elbow joint are recorded (LINDSAY, 1969a). The present study is along accurate follow up observation to the ossification loci from the first day postnatal till complete fusion of each locus which reached to 8 years old. Also radiographs were taken from living animals where the most previous studies depended on skeletal specimens.

FLORA and LINDSAY (1969) discarded the term "locus". Authors used the same term (locus), because it is more near to radiographic nomenclature. But the term "centre", may be near to histological description.

It has been concluded that the ossification loci around the elbow joint fused at age of about 8 months (trochlea humeri), 2 years (epicondylus medialis), 1 year (Caput radii) and 4 years (tuberolecranii).

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LEGEND

Fig. 1: Lateral radiograph of the elbow joint of one day old Balady cow.

1, Humerus. 2, Radius 3, Ulna,

* Ossification loci:

- a, Distal epiphysis of Humerus,
- b, Medial epicondyle of Humerus.
- c, Proximal epiphysis of the radius.
- d, Proximal epiphysis of the ulna.
- e, Lateral epicondyle of humerus.

* The arrows indicate the epiphyseal lines.

Fig. 2: Lateral radiograph of the elbow joint of 18 weeks old Balady cow shows:

a, Narrowing of the epiphyseal line of the distal epiphysis of the humerus.

Fig. 3: Lateral radiograph of the elbow joint of 32 weeks old Balady cow shows:

- a, Complete fusion of the distal epiphysis of the humerus.
- c, Incomplete fusion of the proximal epiphysis of the radius.

Fig. 4: Lateral radiograph of flexed elbow joint of 12 months old Balady cow, shows:

- b, An irregular epiphyseal line which separate the medial epicondyle from the diaphysis of the humerus.
- d, Increased irregularity of the epiphyseal line of the proximal epiphysis of the ulna.

Fig. 5: Lateral radiograph of flexed elbow joint of 19 months old Balady cow, shows.

b, Narrowing of the epiphyseal line of the medial epicondyle of the humerus.

Fig. 6: Lateral radiograph of flexed elbow joint of 25 months old Balady cow, shows:

b, Complete fusion of the medial epicondyle of the humerus.

d, Very narrow irregular epiphyseal line of the proximal epiphysis of the ulna.

- Fig. 7:** Lateral radiograph of flexed elbow joint of 9 weeks old Balady cow, shows:
 c, Narrowing of epiphyseal line of the proximal epiphysis of the radius.
- Fig. 8:** Lateral radiograph of flexed elbow joint of 11 months old Balady cow, shows:
 c, Complete fusion of proximal epiphysis of the radius.
- Fig. 9:** Lateral radiograph of flexed elbow joint of 40 months old Balady cow, shows:
 c, Incomplete fusion of proximal epiphysis of the ulna.
- Fig. 10:** Lateral radiograph of the elbow joint of 48 months old Balady cow shows:
 d, Complete fusion of the proximal epiphysis of the ulna.

The arrows indicate the epiphyseal lines.

Fig. 1: Lateral radiograph of the elbow joint of 18 weeks old Balady cow shows:
 a, Narrowing of the epiphyseal line of the distal epiphysis of the humerus.

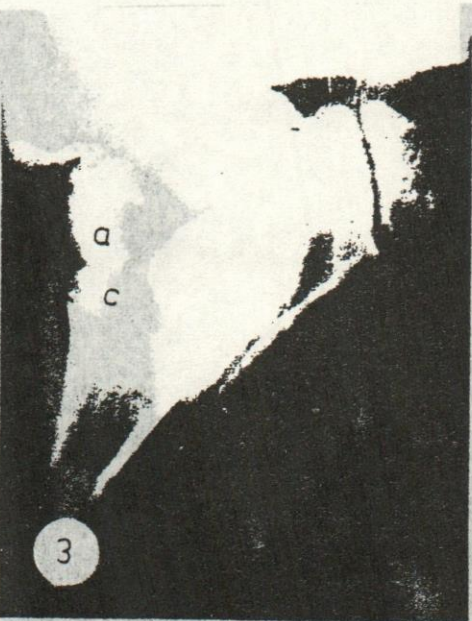
Fig. 2: Lateral radiograph of the elbow joint of 32 weeks old Balady cow shows:
 a, Complete fusion of the distal epiphysis of the humerus.
 c, Incomplete fusion of the proximal epiphysis of the radius.

Fig. 3: Lateral radiograph of flexed elbow joint of 18 months old Balady cow shows:
 b, An irregular epiphyseal line which separate the medial epicondyle from the distals of the humerus.
 d, Increased irregularity of the epiphyseal line of the proximal epiphysis of the ulna.

Fig. 4: Lateral radiograph of flexed elbow joint of 19 months old Balady cow shows:
 d, Narrowing of the epiphyseal line of the medial epicondyle of the humerus.

Fig. 5: Lateral radiograph of flexed elbow joint of 25 months old Balady cow shows:
 d, Complete fusion of the medial epicondyle of the humerus.
 b, Very narrow irregular epiphyseal line of the proximal epiphysis of the ulna.

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