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Original Research Article

The relation between the growth plate closure in tibia and the age of sheep and goat: Medicolegal study

Gehan B.Youssef, Bakry HH, El-Shwarrby R.M, Nabila M. Abd El-Aliem, Elham. A El-Shewy
Forensic medicine and Toxicology dept. Faculty of Veterinary Medicine, Benha Univ. Egypt

***Corresponding author**
Gehan B.Youssef
Email: drgehan222@yahoo.com

Abstract: This study was done on 108 sheep and goat at different farms in Kalyobia governorate. Radiographic images of the tibia bone in both ram and buck was shot at different ages. The radiographic images of the tibia showed radiolucent appearance in the epiphyseal plate at which no ossification occurred and the epiphyseal plate opened at age of 2-10 months in sheep and goat. While the partial union appeared at the age of 12-18 months and 18-24 months in sheep and goats respectively. The total union occurred between the epiphysis and diaphysis at age of 30-36 months and 28-30 months in sheep and goats respectively. The complete closure of the growth or epiphyseal plate of the tibia appeared in the radiographic images as complete union between the epiphysis and diaphysis appeared at age of (42-48) months and 36-42 months in sheep and goats respectively.
Keywords: Tibia-Radiographic images - growth plate -Sheep-Goat-Medicolegal study.

INTRODUCTION

The age determination by long bone fusion is method used by zoarchaeologists around the world. There are systemic differences between sheep and goat in the time of epiphyseal fusion (growth plate closure) , as the long bones of sheep fuse earlier than in goats and conversely that goat long bones fuse later than in sheep as reported by Zeder[1]. In the long bones the diaphysis and both epiphysis are separated by a growing zone of cartilage (epiphyseal plate),then at the age of skeletal maturity all of the cartilage is replaced by bone , the diaphysis and both epiphysis fuse together and this is called epiphyseal closure as stated by Kini and Nandeesh [2].

Radiography is the primary diagnostic imaging for the evaluation of musculoskeletal disorders and can provide the morphologic characterization of bone which lead to formation of a definitive or differential diagnosis according to Kraft and Gafin [3] and Latorre *et al.* [4].

The age of closure of the epiphyseal plates has been reported to vary according to animal's breed and species[5-7] also the physiology of growth plate and the time of closure of growth plate are complex and vary among bones as studied by Kilborn *et al.;* [10]. At puberty, the bone growth stop and the growth plate was closed at this time while the appositional bone growth still working and progress which lead to change in the shape of the bone[8].

According to radiographic study of long bones in black Bengal and Ganjam goats by Das *et al.* [9] the closure of proximal epiphyseal plates in femur occurred after 28 months while the distal plates obliterated (complete epiphyseal closure) after 36 months and the closure time of the epiphyseal plates of the tibia occurred after 28 months in both breads of goats. They added that the ossification and the epiphyseal closure increased with increasing the age.

The growth plate closure (cessation of the longitudinal bone growth) occurred relatively early in the life of rabbits ,cats and dogs while the closure of growth plates occurred later in the life of in human and human primates[10].

The aim of the current study is to study the relation between the growth plate closure and the age of the tibia bone in the sheep and goat through radiographic images.

MATERIAL AND METHODS

This study was done on 108 animals (54 male goats (Bucks), and 54male sheep (Ram), their age ranged from 2 months to 4 years. They were apparent healthy and not suffer from any diseases or anomalies by physical and clinical investigations. These animals were collected from different small ruminant farms in Kalyuobia Governorate; Farm of Faculty of Veterinary medicine, Farm of Faculty of Agriculture, Benha

University and Farm of Ministry of Agriculture farm at Moshtoher village. The animals were collected for radiographic examination to the long bones of the tibia at different ages from two months till reached 48 months of age.

Radiography of tibia

The animal lies on the examined side with the limb to be radiographed slightly flexed and maintained in the true lateral position. The fore limb is pulled clear. The x-ray beam is directed center to the midpoint of the tibia and fibula.

X rays (Radiographic image)

The radiographic examinations were done for the animals of the present study. For radiographic shot, 100 kilovolts (kV), 60 Amperes (Am) digital device for diagnostic imaging. The radiographic images were taken to the tibia of both sheep and goats. Each animal was assessed to ensure they were not lamed and their limbs were free from any external evidence injury or disease.

The radiography is taken to the animals (sheep and goats) in lateral position according to Douglas *et al.* [11]. Before any examination the animals was dried and groomed because of the fleece of the sheep often contain a large amount of dirt and becomes radiopaque when wet.

RESULTS

Radiographic images of the sheep (ram) tibia

The tibia was long bone situated between the femur and the metatarsal. It composed of one shaft and two extremities. The proximal extremity of the tibia formed the stifle joint with the femur while the distal extremity of the tibia formed the hock joint with the metatarsal bone. There was no distinct fibula appeared on the radiography of the sheep

The radiographic images of the tibia showed radiolucent appearance in the epiphyseal plate at which no ossification occurred and the epiphyseal plate opened. This occurred at age of 2-10 months of sheep as shown in plate (1A).

The appearance of radiopaque area in radiography of tibia in the epiphyseal plate at which partial union occurred and this appeared at the age of 12-18months in sheep as shown in plate (1B).

The complete closure occurred on the radiographic images in the form of appearance of radiopaque area and disappearance of radiolucent area in radiography of the tibia. The total union occurred between the epiphysis and diaphysis .This appeared at age of 30-36months of sheep as shown in plate (1C).

The complete closure of the growth or epiphyseal plate of the tibia appeared in the radiographic images as complete union between the epiphysis and diaphysis and disappearance of the radiopaque line between the epiphysis and diaphysis .This appeared at age of (42-48) months of sheep as shown in plate (1D).

Plate.1: showing the radiographic images of sheep tibia

In (1A), the growth plate opened at the age of 4 months. In (1B), showed partial union at 14 months. In (1C), showed total union of growth plate at 30 months. In (1D), showed complete growth closure (complete union) and disappearance of radiopaque line at 42 months.

Radiographic images of the goat tibia

The radiographic images of the tibia showed radiolucent appearance in the epiphyseal plate at which no ossification occurred and the epiphyseal plate opened. This occurred at the age of 2-10 months as shown in plate (2A). The appearance of radiopaque area in radiography of tibia in the epiphyseal plate at which

partial union occurred and this appeared at the age of 18-24 months as shown in plate (2B).

The complete closure occurred on the radiographic images of tibia in the form of appearance of radiopaque area and disappearance of radiolucent area. The total union occurred between the epiphysis and diaphysis .This appeared at age of 28-30 months of goat as shown in plate (2C).

The complete closure of the epiphyseal plate of tibia appeared in the radiographic images as complete union between the epiphysis and diaphysis and disappearance of the radiopaque line between the epiphysis and diaphysis .This appeared at age of 36-42 months of goat as shown in plate (2D).

Plate 2: showing the radiographic images of goat tibia

In (2A), the growth plate opened at 2months. In (2B), showed partial union at 18 months. In (2C), showed total union of growth plate at 28 months. In (2D), showed complete growth closure (complete union) and disappearance of radiopaque line at 40 months.

DISCUSSION

Human and non human primates , cows and sheep are considered adults at the age when the growth plate closure occurs[12, 13] while the findings of Hillyer [15] and Feldman and Nelson [16] stated that rabbits ,dogs and cats described as very young adults at the time of growth plate closure.

Radiological imaging is an effective method in estimation of the age of the animals through determination of the ossification and bone epiphyseal closure[17].The endochondral ossification regions of the long bones are epiphyseal plates (growth plates).

These epiphyseal plates are existed until the postnatal growth is completed and ossified after the process of postnatal growth[17, 18]. In the present study, the determination of the age of animals was done by radiographic examination of the long bones of the sheep and goats.

In the present study the complete closure of the epiphyseal plates appeared on the radiographic images as the appearance of radiopaque area and disappearance of radiolucent appearance between the epiphysis and diaphysis. This result was agreement with the studies by Todhunter *et al.* [19], who identified the complete closure of the epiphyseal plates by the displacement of radiopaque appearance with the radiolucent line between the epiphysis and diaphysis.

The complete epiphyseal closure of the tibia in this study appeared at age of (42-48) and (36-42) months in the sheep and goats respectively. The age of epiphyseal closure of the tibia in our study differ from the result of Das *et al.*[9] who reported that the closure time of the epiphyseal plates of the tibia occurred after 28 months in black Bengal and Ganjam goats.

In contrast the result of Choi *et al.* [20] who found the closure time of the epiphyseal plates of the tibia was found at 1 year or more than 1 year after radiographic examination of growth plates in the Korean native goat and the result of Alpdogan *et al.* [21] who studied the radiography of tibia and fibula in colored Mohair goats and recorded that the complete closure of the epiphyseal plates of the tibia detected at the age of (15-17) months.

There was no distinct fibula in the sheep and goats as stated by Fillios and Blake[22] and this was similar to our results.

CONCLUSION

The radiographic images can use as a significant tools in forensic medicine in determination of age in sheep and goat in farms.

REFERENCES

1. Zeder MA; Reconciling rates of long bone fusion and tooth eruption and wear in sheep (Ovis) and goat (Capra).9th ICAZ conference, Durham, recent advances in aging and sexing animal bones (ed. Deborah Ruscillo) 2002; 87-118.
2. Kini U, Nandeesh B.N; Physiology of Bone Formation, Remodeling, and Metabolism. Radionuclide and Hybrid Bone Imaging, Springer-Verlag Berlin Heidelberg, 2012; 29-57.
3. Kraft SL, Gavin P; Physical principles and technical considerations for equine computed tomography and magnetic resonance imaging. Vet. Clinc. North Am: Equine Pract. 2001; 17: 115–130.
4. Latorre R, Arencibia A, Gil F, Rivero M, Henry RW, Ramirez G *et al.;* Correlation of magnetic resonance images with anatomic features of the equine tarsus. Am.J.Vet.Res 2006; 67:756-761.
5. Noodle B; Age of epiphyseal closure in feral and domestic goats and ages of dental erruption. J. of Archaeological science 1974; 1(2): 195-204.
6. Smith B.L, Auer J.A, Taylor TS, Hulse DS, Longnecker MT; Use of orthopedic ma-proksimal radial and ulnar growth in foals. Am. J. Vet Res, 1991; 52:1456-1460.
7. Genccelep M, Bakir B, Aslan L, Atasoy N, Tas A; Determination of the closure time in Morkaraman lambs by radiography. YYU Vet. Fak. Derg. 2002; 13:1-7.
8. Rauch F; Bone growth in length and width: the Yin and Yang of bone stability. J Musculoskelet Neuronal Interact 2005; 5:194-201.
9. Das RK, Kanesh J.S, Mandel AK, Mishra UK; Comparative radiographic study on the epiphyseal closure in long bones of hind limb in Black Bengal and Ganjam goats. Indian Journal of Veterinary Anatomy, 2009; 21(2):49-52.
10. Kilborn SH, Acvim D, Trudel G, Uhthaff H; Review of growth plate closure compared with age at sexual maturity and lifespan in laboratory animals. American Association for laboratory animal science, 2002; 41(5):21-26.
11. Douglas SW, Herrtage M.E, Williamson HD; Principals of veterinary radiography, Bailliere Tindall 1987, London Philadelphia, Toronto, Mexico City ,Sydney, Tokyo, Hong Kong. 4th edition, 1987; part 2: 339.
12. Johnson D.C.A; primates. Vet. Clin.North Am. Small Anim. Pract. 1994; 24(1):121-165.
13. Masoro E.J; Aging: Current concepts. In E.J. Masoro (ed.) Hand book of physiology, section II: Aging, 1st ed. Oxford University press, New York. 1995; 4-5.
14. Hillyer E.V; Pet rabbits. Vet. Clin.North Am. Small Anim. Pract. 1994; 24(1):25-64.
15. Feldman E, Nelson R.W; Canine and feline endocrinology and reproduction.2nd Ed. W.B. Saunders co. Philadelphia, 1996.
16. Asimus E, Gauzy JS, Mathon D, urgeois F, Darmana R, Cahuzac J, *et al.;* Growth of the radius in sheep. An experimental model for monitoring activity of the growth plates. Rev. Med. Vet.1995; 146: 681–688.
17. Aytekin Y; Basic Histology. Baris Bookstore, Istanbul, Turkey, 1993; 179-191.
18. Aslanbey D; Veterinary Orthopedics and Traumatologie. Medipres Publishing House Malatya Turkey, 2002; 3-7.
19. Todhunter RJ, Zachos TA, Gilbert RO, Erb HN, Williams AJ, Burton –Wurster *et al.;* Onset of epiphyseal mineralization and growth plate closure in radiographically normal and dysplastic Labrador Retrievers. J. Am. Vet. Med. Assoc., 1997; 210:1458-1462.
20. Choi H, Shin H, Kang S, Lee H, Cho J, Chang D,*et al.;* A radiographic study of growth plate closure compared with age in the Korean native goat. Korean J. Vet. Res. 2006; 46 (3):285-289.
21. Alpdogan O, Genccelep M; Determination of the closure time of growth plates of tibia and fibula in colored Mohair goats kids by radiography .Asian Journal of Animal and Veterinary Advances, 2012; 7(9): 860-867.
22. Fillos M, Blake N; Animal bones in Australian archaeology, Afield guide to common native and introduced species. Tom Austen brown studies in Australian archaeology. Chapter 8, 2015; 97.