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Arteriographical Evaluation of Normal Digit and Hoof in Goat

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Abstract

Objectives- To determine normal circulatory pattern of distal limbs of goat to be used for comparison with diseased digits or hooves of small ruminant lameness examination.
Design- Experimental study.
Animals- Forelimbs and hindlimbs of 10 healthy goats of both sexes, were collected fresh immediately after slaughter.
Procedures- The plantar and Palmar artery were dissected and catheterized by eighteen gage catheters. 10 ml contrast medium was injected by the catheter. Radiographs were obtained in lateral and dorsoplantar and dorsopalmar views respectively. Fine details of blood vessel were evaluated in radiographs.
Results- The medial digital artery of the forelimb descends on the medial side of the medial digit and terminates at the bulb of claw by anastomosing with the corresponding proper digital artery. The lateral digital artery arises from the deep arch, passes down on the lateral side of the lateral digit and is distributed similar to the medial side. The lateral digital artery and the medial digital artery meet each other and anastomose together at the toe and sole forming a uniform net work of marginal capillaries. The main blood supply of the digits region in the hindlimb is essentially the distal extension of those vessels on the dorsal and plantar aspects of the metatarsus similar to the fore limb. The lateral digital artery and the medial digital artery meet each other and anastomoses together at the toe and sole forming a uniform network of marginal capillaries.
Conclusion and Clinical Relevance- No report could be found in the literature regarding arteriographic evaluation of the foot in small ruminant. This study is describing normal arterial pattern of goat's distal limb.
Key Words- Goat, Arterioraphy, Vascular Pattern, Digit.

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Introduction

There are clinical and field studies about cattle lameness problems.[1-5] However, documented studies on small ruminant lameness are lacking in the literature. Sheep and goats are raised in large herd and larger herds mean less labor per animal and therefore less attention to individual animal. Frequently lame sheep and goats are referred to the veterinarians for foot and hoof problems and unfortunately they are treated individually and are not respected as a herd problem, though the herd might have a great risk of lameness. The present study was carried out to determine normal pattern of blood circulation to the foot and digits of goat in order to be used for comparison with diseased digits or hooves of the small ruminant lameness examination.

Materials and Methods

Front limbs and hind limbs of 10 healthy indigenous Iranian goats of both sexes, weighting 30.60 ± 5.3 kg were collected fresh immediately after slaughter and transferred to the laboratory in ice-cold water bags. The plantar and palmar artery were dissected and catheterized by an 18 gage catheter. The artery was flushed by heparinized saline solution (2500 IU/ liter) frequently until clear saline solution was drained out of the artries. Then 10ml contrast medium (Lipidol, ultra-fluid Iodized ethyl esters of fatty acid, 38% w/w, French) was injected trough the catheter. The veins and arteries were kept occluded by hemostats. Radiographs (KVp;55, mAs;20, ms;16 sec) were obtained in lateral, dorsopalmar and dorsoplantar views by a Siemens radiographic machine. The radiographs were processed manually. Then they were evaluated and studied over the negatoscope and fine details of blood vessel patterns were recorded. Any arterial anastamoses was noticed and recorded.

Results

Forelimb

The dorsal metacarpal artery is joined by distal metacarpal artery forming an artery that constitutes the dorsal common digital artery. This vessel divides into two dorsal proper digital arteries. The medial digital artery descends on the medial side of the medial digit and terminates at the bulb of claw by anastomoses to the corresponding proper digital artery. It gives off a branch to the rudimentary digit and forms a transverse anastomoses behind the first phalanx with the common digital or its medial division (Fig.1). It continues downward and form another transverse anastomoses behind the coronary band giving off many branches to the cranial coronary area and cranial part of the hoof wall as well as leading numerous branches to the bulb, hoof, toe, caudal part of the hoof and sole. The lateral digital artery arises from the deep arch, passes down on the lateral side of the lateral digit and is distributed similar to the medial side. The lateral digital artery and the medial digital artery meet each other or anastomoses together at the toe and sole forming a uniform network of marginal capillaries(Fig. 2).

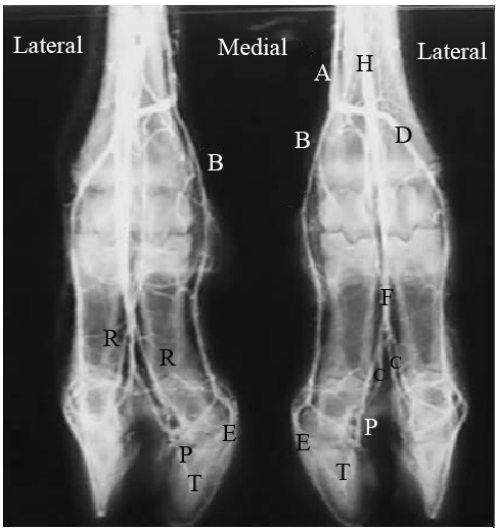

Figure 1. Dorsopalmar arteriographic view of goat forelimb digits. H) dorsal metacarpal artery III. A) Dorsal common digital artery III. B) Palmar common digital artery II. C) dorsal proper digital artery IV and III. D) palmar common digital artery IV. E) medial (abaxial) dorsal digital artery. F) palmar common digital artery III. P) palmar branch of distal phalanx. R) palmar (axial) proper digital arteries III and IV. T) terminal arch.

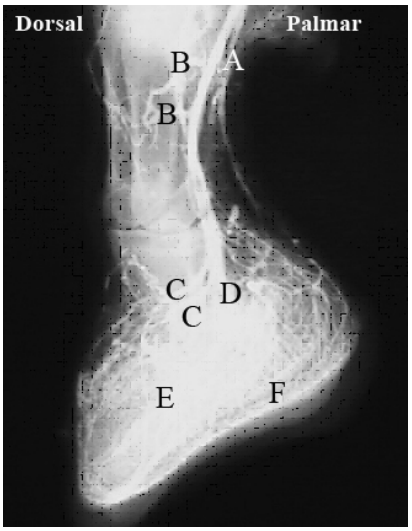

Figure 2. Lateralomedial arteriographic view of goat forelimb digit. A) Palmar common digital artery. B) Dorsal branch to first phalanx. c) Dorsal branch to second phalanx. D) Axial proper digital artery (III+IV). E) Terminal arch. F) Marginal capillaries.

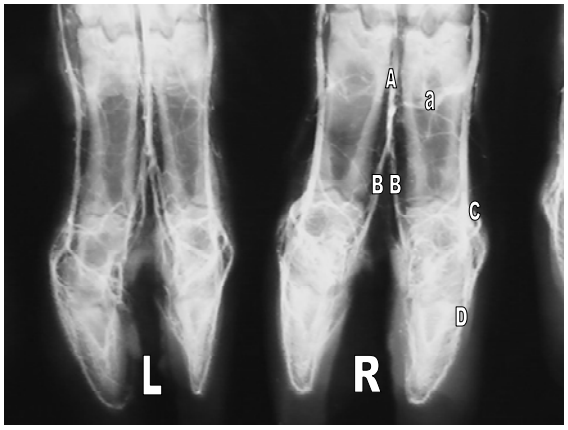

Figure 3. Dorsoplantar arteriographic view of goat hindlimb digits. A) Dorsal common digital artery III. a) Distal deep plantar arch. B) Plantar proper digital artery (III+IV). C) dorsal branch of middle phalanx. D) marginal capillaries. L) left hindlimb digits. R) right hindimb digits. More explanation in fig. 4.

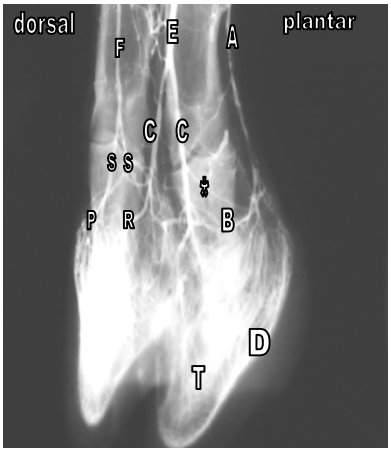

Figure 4. Lateralomedial arteriographic view of goat hindlimb digits (in this position the digits are help apart by string to prevent superimposition).A) palmar common digital artery II. B) dorsal branch of middle phalanx. C) dorsal proper digital artery III and IV. D) marginal capillaries. E) palmar common digital artery III. F) palmar common digital artery IV. *) palmar branch of the proximal phalanx. P) lateral(abaxial) dorsal digital artery IV. R) dorsal branch of middle phalanx. S) palmar proper digital artery IV and V. T) terminal arch.

Hindlimb

Similar to the metacarpal region the arterial supply is represented by superficial and deep arteries on the dorsal and plantar surfaces of the metatarsus. The main blood supply of the digit region is essentially the distal extension of those vessels on the dorsal and plantar aspects of the metatarsus similar to the fore limb (Fig. 3). Too many arterial branches are detected from the terminal branch of the hoof and because of overlapping effects of arteries on the radiograms, determination of their exact number and their diameter was impossible (Fig. 4).

Discussion

No reports could be found on locomotor system study of the small ruminant, nor any disorders of locomotor system especially as a herd problem are recorded. Normal arteriographic study of digital circulation can help in understanding the pathophysiology of the locomotor disorder. Determination of normal circulatory pattern of goat digit can serve as a guide for diagnosis of ethiology of digital circulatory problems especially situations such as healing of digit area, coronary abscess, white line disease, blood stagnation, hemorrhage, sole abscess, sole bruising, trauma to the foot and lacerations. In cattle some diseases are recognized by angiographic study such as: regional thrombosis of digit especially sole, altered circulation in to the dermis of the sole, largely undeveloped terminal arterial arches, small or undeveloped primary arterial arches, small or irregular arterial extension to corium of the coronary band.[4] The appearance of the normal equine foot circulation and it's alterations in the chronic laminitis has been studied.[1,3] Radiographic measurements have been used for equine foot navicular vascular problem.[6] Arteriographical and pathological changes in the chronic laminitis in dairy cattle have been studied.[2,7,8] Angiographic evaluation of vascular changes in the sole lesions in the hooves of cattle has been reported.[9] Major blood vessels to the foot of forelimb and hindlimb are described[10], but fine arteries to sole and foot are not mentioned. Angiography of the caprine hind digits have been performed on live animals under sedation as a research model for Fescue toxicity for the large animal lameness study.[11] They also found similar vascular pattern to goat hooves with that of cattle digital circular pattern. The arteriographical findings of the goat digit in this study was also found to be following similar pattern as in the cattle reported earlier.[2,7,8,12] No report could be found in the literature regarding arteriographic evaluation of the foot in small ruminant. Therefore this study is describing normal arterial pattern of goat foot.

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چکیده:

بررسی آرتریوگرافی انگشت و سم سالم در بز

سیف ا... دهقانی[1]، سپیده عباسی[1] ، مینا تجلی[2]

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هدف- برای مشخص نمودن الگوی سالم عروقی انگشتان بز که برای مقایسه انگشتان بیمار در نشخوارکنندگان کوچک بکار خواهد رفت.

طرح مطالعه- مطالعه تجربی.

حیوانات- دست و پاهای ده رأس بز از هر دو جنس بلافاصله بعد از کشتار از کشتارگاه تهیه شده و مورد مطالعه قرار گرفت.

روش کار- شریان های کف دستی و کف پائی اندام ها شناسائی و جدا شد و به وسیله سوند شماره ۱۸ سوند گذاری گردید. ده میلی لیتر ماده حاجب درون هر شریان تزریق شد و رادیوگراف ها در حالت گماری پشتی کف دستی و پشتی کف پائی تهیه شد و مطالعه گردید.

نتایج- شریان میانی انگشتی دست از قسمت میانی انگشت به پایین می رود و به پشت پاشنه منتهی می شود و با شریان انگشتی اصلی همدهانی می دهد. شریان انگشتی جانبی از قوس عمقی منشعب می شود و از سطح جانبی انگشت جانبی به پایین هدایت می شود و همانند شریان میانی به ساختارهای انگشت انتشار می یابد. شریان میانی و جانبی انگشتی در نوک انکشت و کف سم شبکه عروقی انتهایی(حاشیه ای) را تشکیل می دهند. شریان های اصلی پا از شریان های پشتی و کف پائی همانند دست جدا شده و انتشار می یابد. شریان میانی و جانبی انگشتی در نوک و کف سم شبکه عروقی مویرگی را تشکیل می دهد.

نتیجه گیری و کاربرد بالینی- گزارشی از آرتریوگرافی انگشتی در بز موجود نبود و این مطالعه شبکه شریانی انگشتان دست و پای بز را شرح می دهد.

کلید واژگان- بز ، آرتریوگرافی ، شبکه عروقی ، انگشت.