

GROSS AND RADIOGRAPHIC STUDIES ON ARTERIAL SUPPLY OF METACARPAL AND DIGITAL REGION IN GOAT

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Received: 31.01.2022; Accepted: 16.03.2022

ABSTRACT

Present study was conducted on thoracic limbs of four adult goats collected from local abattoir to know the normal architecture of blood vessels of foot and digits of goat. The median artery was the continuation of the brachial artery and gave off the radial artery in the middle of the forearm. The second, third and fourth palmar metacarpal arteries in goat were the direct continuation of the radial artery, median artery and palmar branch of cranial interosseous artery, respectively. The third dorsal metacarpal artery of goat emanated from the dorsal carpal *rete* and continued as the third dorsal common digital artery at the level of fetlock joint. The third palmar common digital artery of goat was the continuation of the third palmar metacarpal artery and gave off the second and fourth palmar common digital arteries at the level of distal third of metacarpus.

Keywords: Digital artery, Goat, Median artery, Radiography

How to cite: Kumar, A., Jain, R.K. and Gahlot, P.K. (2022). Gross and radiographic studies on arterial supply of metacarpal and digital region in goat. *Haryana Vet.* 61(2): 186-188.

Goats significantly contribute to the livelihood security of the small and marginal farmers especially in arid, semiarid and mountainous regions of the country. Goats are raised in herd and frequently encounter foot and hoof problems. Abnormality or obstruction of circulation of blood vessels of foot and digits affects the physical and productive efficiency of the animal. The present study was carried out to know the normal architecture of blood vessels of foot and digits of goat. The knowledge of normal architecture of blood vessels of foot and digits of goat may be used for examination and treatment of diseased digits or hooves of small ruminants.

MATERIALS AND METHODS

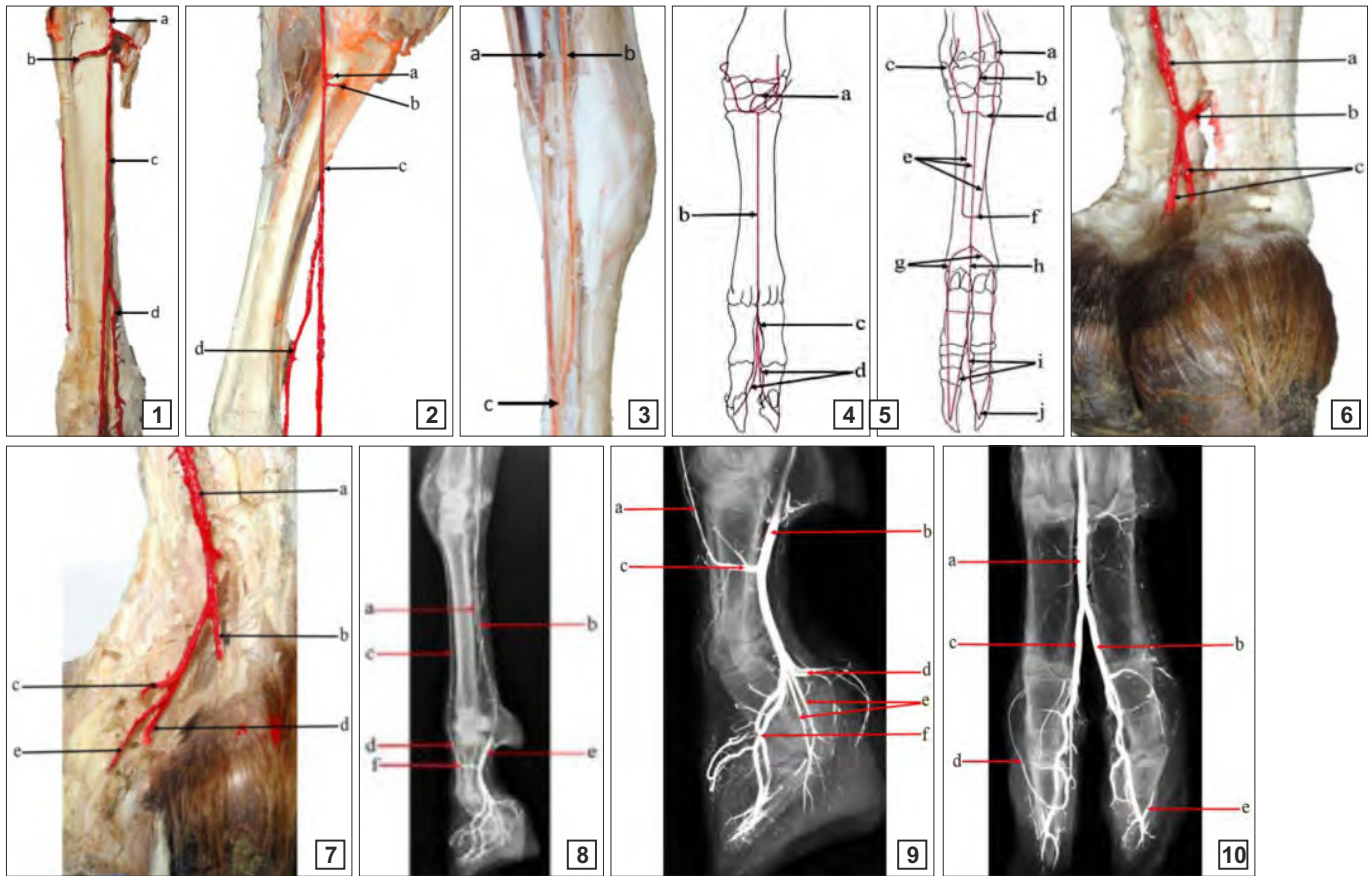
The study was conducted on thoracic limbs of 4 adult goats collected from local abattoir in Hisar, Haryana, soon after the slaughter. The axillary artery on thoracic limbs was exposed and cannulated. The ligatures were applied around blood vessels to prevent the back flow of the solution. The arterial system was thoroughly flushed by injecting luke-warm normal saline solution. After thorough flushing, a radio-opaque suspension (20% w/v lead oxide in liquid soap solution) was injected through the cannula with steady digital pressure. After satisfactory filling, the limbs were radiographed in different views to study the course and branching pattern of the arteries. After that the specimens were kept in deep freeze for 48 hours to settle down the radio-opaque material. Then the limbs were dissected to confirm the radiographic observations. The dissected vessels were highlighted with the red enamel paint for photographic purpose.

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RESULTS AND DISCUSSION

The median artery: The median artery was the direct continuation of the brachial artery after it gave off the common interosseous artery at the level of proximal third of forearm (Figs. 1, 2, 3 and 5) as reported in goat (Kumar and Jain, 2019), in ox, horse and dog (Nickel *et al.*, 1981), in domestic mammals (Konig and Liebich, 2020) and in northern domesticated reindeers (Potapov *et al.*, 2020). Median artery gave off the radial artery in the middle of the forearm of goat. However, Ghoshal (1975) and Nickel *et al.* (1981) reported the origin of radial artery of ox from the median artery in the proximal one third region of the forearm. Whereas, Sisson and Grossman (1953) and Raghavan (1964) in ox stated that the median artery bifurcated into the radial and the ulnar artery in the middle of the forearm. The median artery in goat was continued as third palmar metacarpal artery on the palmar aspect of metacarpus below the level of proximal palmar arch.

The radial artery: The radial artery of goat arose from the median artery in the middle of forearm (Figs. 1, 2, 3 and 5). Similar origin had been reported in sheep and ox (Nickel *et al.*, 1981). However, the radial artery arose in the distal one third region of the forearm in camel (Sajjadian *et al.*, 2015) and (Ibrahium and Shaker, 2018). Raghavan (1964) in ox reported that the radial artery resulted from the bifurcation of the median artery at the level of the middle of the forearm. However, bifurcation of the median artery in buffalo had been reported to take place at the level of distal one fourth of the radius (Sapra and Dhingra, 1974). The radial artery of horse emanated from the median artery proximal to the accessory carpal bone (Ghoshal, 1975).



Figs. 1-10. (1) Photograph showing the arteries of the forearm region (medial view), a, brachial artery; b, common interosseous artery; c, median artery; d, radial artery.; (2) Photograph showing the arteries of the forearm region (medial view), a, deep antebrachial artery; b, common interosseous artery; c, median artery; d, radial artery.; (3) Photograph showing the branching pattern of the median artery (medial view), a, radial artery; b, median artery c. distal palmar arch; (4) Line diagram showing arteries of metacarpal region (dorsal view), a, dorsal carpal rete; b, dorsal metacarpal artery III; c, dorsal common digital artery III; d, dorsal proper axial digital arteries III and IV.; (5) Line diagram showing arteries of metacarpal region (palmar view), a, radial artery; b, median artery; c, palmar ramus of cranial interosseous artery; d, proximal palmar arch; e, palmar metacarpal arteries II, III and IV; f, distal palmar arch; g, palmar common digital arteries II and IV; h, palmar proper axial digital arteries III and IV; i, palmar proper axial digital arteries III and IV; j, arcus terminalis.; (6) Photograph showing the arteries of the digital region (palmar view), a, palmar common digital artery III; b, interdigital artery; c, palmar proper axial digital artery III and IV.; (7) Photograph showing the arteries of the digital region (palmar view), a, palmar common digital artery III; b, palmar proper axial digital artery III; c, bulbar artery; d, distal phalangeal artery IV; e, ramus palmaris.; (8) Arteriograph of metacarpal region (lateral view), a, palmar metacarpal artery II; b, palmar metacarpal artery III; c, dorsal metacarpal artery III; d, dorsal common digital artery III; e, palmar common digital artery III; f, interdigital artery.; (9) Arteriograph of digital region (lateral view), a, dorsal common digital artery III; b, palmar common digital artery III; c, interdigital artery; d, bulbar arteries; e, ramus palmaris; f, distal phalangeal arteries III and IV.; (10) Arteriograph of digital region (palmar view), a, palmar common digital artery III; b, palmar proper axial digital artery III; c, palmar proper axial digital artery IV; d, coronary arterial circle; e, arcus terminalis.

However, in dog the radial artery arose just proximal to the middle of the forearm from the median artery (Evans and Lahunta, 2013). The radial artery in goat gave rise to the dorsal carpal branch and the palmar carpal branch which contributed to formation of the dorsal carpal rete and palmar carpal rete respectively as reported earlier in sheep and ox (Nickel *et al.*, 1981). The radial artery in goat gave off deep palmar branch which participated in the formation of the proximal palmar arch as reported earlier in goat, sheep and ox (Ghoshal, 1975). However, Nickel *et al.* (1981) in sheep and ox stated that the radial artery issued a superficial and deep branch which contributed in the formation of the superficial and deep palmar arches, respectively. The radial artery in goat continued as second palmar metacarpal artery on the palmar aspect of

metacarpus below the level of proximal palmar arch.

The third palmar metacarpal artery: The third palmar metacarpal artery was continuation of the median artery on the palmar aspect of metacarpus below the level of proximal palmar arch (Figs. 5 and 8). Similarly, second and fourth palmar metacarpal arteries in goat was the direct continuation of the radial artery and palmar branch of cranial interosseous artery. Similar observations had been reported in buffalo (Sapra and Dhingra, 1974). However, Nickel *et al.* (1981) reported in sheep and ox that the second, third and fourth palmar metacarpal arteries arose from the proximal deep palmar arch. The third palmar metacarpal artery in goat along with second and fourth palmar metacarpal arteries descended on the palmar aspect of metacarpus and constituted the distal palmar arch at the

level of the distal third of the metacarpus (Fig. 5).

The third palmar common digital artery: The third palmar common digital artery of goat was the continuation of the third palmar metacarpal artery after the latter gave a branch to the distal palmar arch (Fig. 8). However, Ghoshal (1975) and Nickel *et al.* (1981) in ox and Nickel *et al.* (1981) in dog described that the third palmar common digital artery was the continuation of the median artery at the level of fetlock joint. The third palmar common digital artery in goat gave off second and fourth palmar common digital arteries at the level of distal third of metacarpal which continued distally on abaxial surfaces of corresponding principal digits as third and fourth palmar proper abaxial digital arteries respectively as reported earlier in goat (Ghoshal and Getty, 1967). The third palmar common digital artery of goat was bifurcated into the third and fourth palmar proper axial digital arteries in the interdigital space (Figs. 5, 6, 7 and 10) as reported earlier in ox (Mansour *et al.*, 2018). The third and fourth palmar proper axial digital arteries in goat gave off bulbar branch and palmar branch in the interdigital space and entered the corresponding distal phalanx as third and fourth distal phalangeal arteries, respectively (Figs. 7 and 9). They made anastomosis with the terminal branches of the corresponding third and fourth palmar proper abaxial digital arteries within the distal phalanx to form terminal arch (*arcus terminalis*) (Figs. 5 and 10). However, Nickel *et al.* (1981) reported that *arcus terminalis* in ruminants was an arch like link between the axial and abaxial digital arteries which ran down the outside and inside of the toes. Ghoshal (1975) in ox and Sapra and Dhingra (1974) in buffalo reported that the third palmar common digital artery divided into the third and fourth palmar proper axial digital arteries at the level of pastern joint. Ghoshal (1975) described that the axial branches entered into the distal phalanx through the axial foramen and anastomosed with the corresponding palmar proper abaxial digital arteries to form the terminal arch. Sisson and Grossman (1953) in ox stated that the volar common digital artery of ox divided into two volar proper digital arteries in the interdigital space which descend along the axial borders of the third and fourth digits and passed through the foramina into the third phalanx of the corresponding digit and ramified there.

The third dorsal metacarpal artery: The third dorsal metacarpal artery of goat emanated from the dorsal carpal rete and descended on the dorsal aspect of the metacarpus in the longitudinal groove (Figs. 4 and 8). Similar pattern was reported in ox (Ghoshal, 1975) and buffalo (Sapra and Dhingra, 1974). Nickel *et al.* (1981) stated that in ox, the dorsal carpal rete gave rise to a rudimentary fourth dorsal metacarpal artery and a well-developed third dorsal metacarpal artery. In horse the dorsal carpal rete gave rise

to the medial and lateral dorsal metacarpal arteries (Ghoshal, 1975). The third dorsal metacarpal artery continued as the third dorsal common digital artery in goat at the level of fetlock joint.

The third dorsal common digital artery: The third dorsal common digital artery was continuation of the third dorsal metacarpal artery at the level of fetlock joint (Figs. 4, 8 and 9). The third dorsal common digital artery in goat gave rise to the third and fourth dorsal proper digital arteries at the level of middle of the first phalanx and opened into the third palmar common digital artery through interdigital artery (Figs. 4, 8 and 9). Similar description was given in ox (Nickel *et al.*, 1981 and Ghoshal, 1975) and buffalo (Sapra and Dhingra, 1974). However, Nazhvani *et al.* (2007) reported that dorsal common digital artery was formed by joining of dorsal and distal metacarpal arteries and dorsal common digital artery divided into two dorsal proper digital arteries.

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